NEAR EAST UNIVERSTY

Faculty of Engineering

Department of Electrical and Electronic

Engineering

WAILING ALARM SIREN AND TOUCH SWITCH

Graduation Project
EE 400

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Finally I send my best regards to my family for their support of allowance

ABSTRACT

This Project is about Alarm System, their structures, function, types, devolopment, etc...and situation importance of alarms in our daily lives.

The desigation and structures of this project is divided into two catogory. These are Alarm and Siren. However siren can be modifed by use of Raid Alarms, Pnematic Alarms, and Elecronic Alarms.

The main aim and object of this Project is to research and provide information about princibles and tecnological improvments of alarm system and being frequented my wonders and interest about alarms system. And have realised the place of alarm system and siren in our daily life. Such as keeping our assets in safe and taking ourselves in safe.

On the other hand the iner structure of a general alarm system such as wailing alarm system there are three main elements consisting ;transistor, 555 timer, some necessary resistors and capacitors.

Finally the project is finished and designed a wailing alarm system sample circuit.Then have constructed this sample circuit to the project board after that I have added a 8 ohms 3 watts speaker and put all these circuit project and speaker into the project box. At last I used an open/closed switch in order to open and close the alarm(circuit).

As a result of collection and putting in order these researchment information details and sample circuit project, have prepared and finalised this project. However have given and mentioned the necessary information about the project such as structure and functions of the elements that we use in the circuit, the alarm system types.

Overview

- Definition of a siren
- Parts components and design of a siren
- Types of sirens
- Importance of sirens
- How to prevent failure

What is a siren?

- A siren is an acoustic device producing a loud often wailing sound as a signal or warning.

Parts of a siren

- The sirens are composed of:
  - a battery
  - capacitors
  - resistors
  - switches
  - a chip,
  - transistors
  - and a speaker.

Basically the heart of the siren is the chip integrated on the circuit.
Some signal is then send as an input which activate the output indicator letting it know there is some type of output

how does a siren works?

- When the switch is closed, the siren continuously cycles through a complete high low oscillation pattern and activates the output indicator.
- The Output Indicator is a sensor that lights up when it senses the siren sending out a signal to the speaker which produces sound.

Closing the switch will send some signal to output producing sound

Types of sirens

- ☐ Air Raid Siren
  - Sirens on emergency service vehicles: Ambulances, police cars, fire engines.
- ☐ Pneumatic sirens
  - Protecting vehicles passing or turning though an intersection
- ☐ Electronic sirens
  - Clearing traffic in front of vehicles

Why is Siren important?

- ☐ Security
  - Buildings,
  - Automobiles
  - Homes
- ☐ Natural disasters
  - Earth quake
  - Tornados
  - Tsunamis
- ☐ Emergencies
  - Ambulance
  - Police
  - Fire fighter
  - War
- ☐ Detects if there is failure on equipments
  - Airplanes: awareness such as flight attitude, altitude, speed, system performance, and monitoring of offensive and defensive weapons system.

How to prevent a siren from failure?

- ☐ Have a back up system that feed the power outage
- ☐ Good maintenance
- ☐ Drills
- ☐ Protect signal against unauthorized intrusion
  - Using an on-off key switch lock
  - Using a small reset switch

Chapter 1:

Alarm System and Statement

1.1 Introduction:

Sound is one of the physical attributes of the environment for which human beings as well as animals have developed a special sense. As with the sense of vision and smell we can perceive vibration in the air around us. The sound is amplified anatomically and neurologically to allow us to know things around us and learn how to recognize them immediately. Sound can be defined as the series of pressure changes which are almost always present in any fluid in nature. The same way a sirens produce different type of sounds when something is intended to be communicated, depending in the organization trying to inform or to call people's attention letting them know there is an emergency.

1.2 What is a siren?

A siren is an acoustic device producing a loud often wailing sound as a signal or warning. Sirens are composed of batteries, capacitors, resistors, switches, chips, transistors and speakers.

1.3 Types of sirens:

Air Raid Siren or the sirens on emergency service vehicles: Ambulances, police cars, fire engines.

Pneumatic siren: a free aero phone and consist of a rotating disk with holes in it, called rotor. The material between the holes interrupts a flow air from fixed holes on the outside of the unit or stator. As holes in the rotating disk alternately prevent and allow air to flow it alternates compressed and rarefied air pressure (sound). These sirens can consume large amounts of energy.

Electronic siren: incorporates circuits such as, oscillators, modulators, and amplifiers to synthesize a selected siren tone (wail, saw tooth, bell ring or beebaw) and is played through external speakers. Electronic sirens are better for clearing traffic in front of vehicles, while pneumatic sirens are better at protecting vehicles passing or turning though an intersection.

1.4 Why a siren is important?

It detects if there is failure in equipments, It saves live letting people know there is a fire, or a natural disaster, such as earth quake, tornado, war alerting and is also used for security in buildings, automobiles. Siren and its direct predecessors stem from music systems that developed in the process music compositions. Sirens were first used for Musical Application by the French composer Edgard Varese, called the father of the electronic music for his contribution to advances in technology in today's music.

He led the new way of making music by taking traditional instruments in combination with sirens. Varese prepared for a career as an engineer by studying mathematics and science. He studied the notebooks of da Vinci. Pulled towards music, he used his learned scientific principles to study the science of sound. Today, siren is written for the Visual Works Smalltalk system, and is still in-progress, but already supports MIDI I/O as well as sound synthesis and sound file processing. There is even a software called MODE (Musical Object Development Environment) using thee siren system for the purpose of music and sound composition, processing, performing and analysis system.

1.5 What produces the different sounds in sirens?

With acuteness of hearing come the need to compensate for these wide variations and also a need to make some sense of the many vibrations. That is how the difference between sound, noise and signal come to be important

1.5.1 How does a siren work?

A siren uses a perforated disk or drum to alternately block and unblock a stream of air. The classic siren has a spinning disk with a pattern of holes around its periphery. This disk is spun in front of a jet of air, producing pressure pulses that we hear as sound. A more modern siren has a spinning centrifugal fan that propels air radially outward through a pattern of holes in a drum around the fan. This centrifugal siren is much louder than the disc siren because the centrifugal system pushes large pulses of air through many openings at once, whereas the disc siren only has one pulsed source of air.

After all components are put together there is some signal send as an input which activate the output indicator letting it know there is some type of output.

1.5.2 What does the Output Indicator do?

The Output Indicator is a sensor that lights up when it senses the siren sending out a signal to the speaker. This provides a quick and easy diagnostic feature to help solve problems between a siren, speaker, and speaker wiring.

When sirens are used for security: every security system must include a security controller, a DC battery pack, battery connectors, horn siren, wire nuts, cable ties, quick splices, door contact switches, spacers, tie mounts, L-brackets, Some Sirens also consist of a DIP Switch programmability and Face Programmability with User Lock-Out. DIP switch programmability is an improved method for selecting how a unit will function over traditional jumpers. A DIP switch allows the installer to easily turn on or off select functions to semi-customize the unit for the desired environment. Face programmability with User Lock-out allows the installer to completely customize the unit for their specific needs through a push of the buttons and then they can lockout users from re-programming in the field.

installation instructions, and warning label. Signal siren must also be protected from unauthorized use by using either an on-off key switch lock, or a small reset switch. The on-off key switch lock (which is drilled into the protected equipment) is simply turned off before the protected service door is opened, and then turned back on when the machine has been serviced.

1.6 How do we prevent siren failure?

One way to approach this problem is to have some sort of back-up system like the one for places that lack a developed communication infrastructure. Siren failure is likely to be caused by power outages, damage to the siren itself during an earthquake or problems with the mechanism that have gone unnoticed.

1.7 Importance of different types of siren alarms

An option in deciding what type of siren signals to use is to make sirens give several different levels of warning through the use of different colored flashing lights and/or different sounding alarms. This, however, greatly increases the probability that people will be confused and not know to evacuate when they need to. Even if people are taught the differences between the alarms, differences in sounds can easily be confused or forgotten. Also, even if people could always distinguish between different warnings, having the sirens go off in the case of tsunami advisories in addition to warnings will make people more accustomed to hearing them, fostering complacency. This effect is similar to that of having too many false alarms; it is like. Considering, that if just one type of siren is activated in the case of a warning (when evacuation is necessary), as soon as people hear the siren, there will be no ambiguity as to its meaning. For this situation it is important to have some back-up way to quickly get out the warning depending on what resources are available and on local customs.

Chapter 2

Components of Siren Systems:

The sirens are composed of:

- capacitors
- resistors
- transistors
- timer
- and a speaker.
- switches

Basically the heart of the siren is the chip integrated on the circuit.
Some signal is then send as an input which activate the output indicator letting it know there is some type of output .

2.1 The Capacitor

The diagram below shows two metal conducting plates, close enough to react. If electric charge Q is applied to one conductor, -Q appears on the other. When two conductors are oppositely charged there is a force of attraction between them. The area in which this force can be detected is known as the ***electric field***. The pattern of the field can be seen via its lines of ***electric flux*** through the medium between the conductors, such as in the diagram.

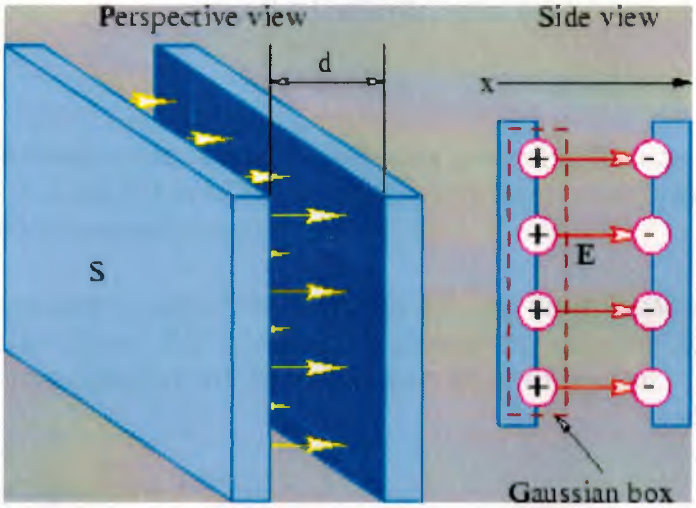


figure 2.1 (a) Metal conducting plates

The two metal plates in the diagram form a capacitor. The capacitor consists of an insulating material known as a ***dielectric***, sandwiched between two electrodes. The electrodes usually consist of metal plates. A ***capacitor*** is a device that facilitates the establishment of electric flux. Another way of stating this is that it is a device that has a capacity for storing charge. The lines of electric flux are in fact directly proportional to the charge. The amount of electric flux set up or the amount of charge stored depends on the size of the electrodes, the properties of the dielectric and the applied voltage to the device. The capacitance is therefore defined as C

$$C = \varepsilon \frac{A}{d} \text{ farads}$$

A is the area of the plates, d is the separation between them and ε is a property of the dielectric known as the ***permittivity***. It is analogous to the conductivity of a conductor. Capacitance, C, is measured in farads.

The presence of charge gives rise to a voltage V across the capacitor.

$$Q = CV$$

⇨ voltage across the capacitor is linearly proportional to the charge on its plates. Therefore the capacitance of a device can also be defined as follows:

$$C = \frac{Q}{V} \text{ farads}$$

The farad is the capacitance of a capacitor between whose electrodes there is a potential difference of one volt when the charge of the capacitor is one coulomb.

If we differentiate Q = CV, we get the following

$$dQ/dt = C\, dV/dt$$
$$=>$$
$$i = C\, dV/dt$$

The rate at which the charge on the capacitor increases is equal to the current flowing into the capacitance. A capacitor in a DC circuit will have no current flowing through it and therefore behave like an open circuit.

In texts the ideal capacitor is sometimes referred to. The ideal capacitor retains the stored charge once the source that was used to charge the capacitor is removed. In reality the charge from a capacitor will leak once the source is removed.

2.1.1 Energy in the Capacitor

As stated already the capacitor stores energy. We can derive an expression for the energy stored in the capacitor. Suppose a capacitor is initially uncharged.

At t=0, v(t) is applied. Recall the expression for power (introduced during a tutorial) p(t) = v(t)i(t)

$$E = \int_0^t p(t)dt = \int_o^t v(t)i(t)dt$$

$$E = \int_o^t vC\frac{dv}{dt}dt$$

$$E = \int_o^t \frac{1}{2}C\frac{d}{dt}(v^2)$$

$$E = \frac{1}{2}C[v(t)]^2 - \frac{1}{2}C[v(t=0)]^2 = \frac{1}{2}C[v(t)]^2$$

2.1.2 Capacitors in Series and Parallel

Consider two capacitors in series as shown. The symbol for a capacitor is two parallel lines.

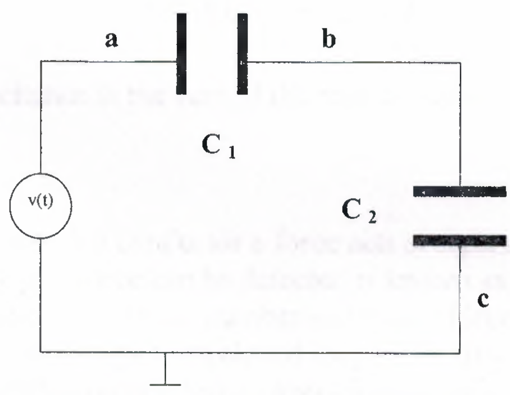


figure 2.1 (b) capacitor in series

Using KVL and summing around the loop:

$$v_{ac} = v_{ab} + v_{bc}$$

$$\text{but} \quad v_{ab} = \frac{Q_1}{C_1}, v_{bc} = \frac{Q_2}{C_2}$$

$$\text{and} \quad Q_1 = Q_2 = Q$$

$$\Rightarrow v_{ac} = Q\left(\frac{1}{C_1} + \frac{1}{C_2}\right)$$

$$= Q\left(\frac{C_1C_2}{C_1 + C_2}\right)$$

Consider two capacitors in parallel. The effect of placing them in parallel is to effectively increase the area of the plates and thus the overall capacitance.

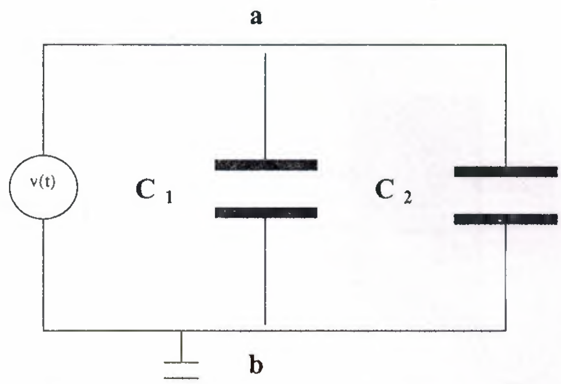


figure 2.1 (c) capacitor in parallel

$$Q_1 = C_1 V, Q_2 = C_2 V$$
$$\text{but } Q_{total} = Q_1 + Q_2$$
$$\Rightarrow Q_{total} = C_1 V + C_2 V$$
$$= V\left(C_1 + C_2\right)$$

Thus the effective capacitance is the sum of the total capacitance.

2.1.3 The Inductor

When a current flows through a conductor a force acts at right angles to the direction of flow. The area in which this force can be detected is known as a ***magnetic field***. The ***magnetic flux*** is a measure of the total number of lines of force associated with the magnetic field. These lines always form closed loops. The flux is proportional to the current. To concentrate the magnetic flux in a small area a wire in the shape of a loop or a **coil** is used. If this flux changes it is possible to induce a potential difference in the coil. Therefore if a varying current flows through a coil a potential difference is induced across that coil. This has the effect of storing the magnetic energy in the coil and the arrangement is known as an ***inductor***. The diagram below shows an inductor.

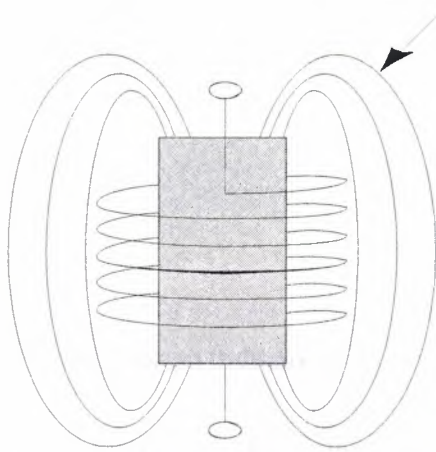


figure 2.1 (d) shows an inductor

L is known as the ***inductance*** of the coil and is measured in henrys. A circuit has an inductance of one henry if an e.m.f. of one volt is induced in that circuit when the current flowing through it varies uniformly at the rate of one ampere per second.

The inductance of the circuit depends on the magnitude of the current flowing through it, the number of turns in the coil and the amount of magnetic flux lines, Φ, set up by the coil.

$$N\ \Phi = Li \quad \text{henry-amperes}$$

NΦ and i being the linkage and the current at any instant *when the current is varying*. It is in alternating circuits that inductors have their chief uses.

The coil may be wound around an iron core. The p.d. across the coil is related to the rate of change of the current by the following formula:

$$v_{ab} = L\frac{di}{dt} \quad \text{volts}$$

The inductor behaves much like a capacitor with the roles of current and voltage reversed. If the current through an inductor is constant, then the voltage across the inductor is zero.

The current flowing in an inductor is given by:

$$i(t) = \frac{1}{L}\int_0^t v(t)\,dt$$

Energy in the Inductor
As in the case of a capacitor an expression can be derived for the energy stored.

$$E = \int_0^t p(t)dt = \int_o^t v(t)i(t)dt$$

$$E = \int_o^t L\frac{di}{dt}i(t)dt$$

$$E = \frac{1}{2}Li^2$$

The Inductor in Series & Parallel

Consider two inductors in series. The symbol for an inductor is a curly symbol as shown in the diagram.

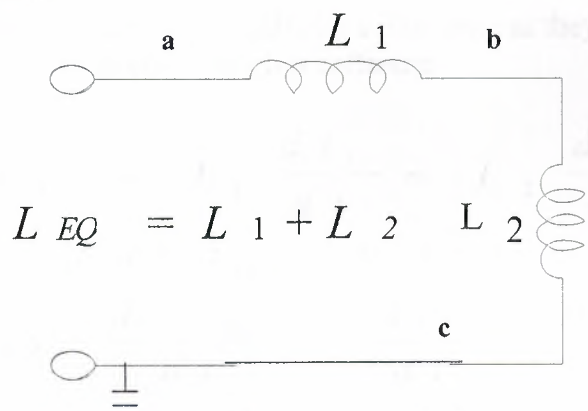


figure 2.1(e) inductor in series

Summing around the loop using KVL we get:

$$v_{ac} = v_{ab} + v_{bc}$$

$$\text{but} \quad v_{ab} = L_1\frac{di}{dt}, v_{bc} = L_2\frac{di}{dt}$$

$$\Rightarrow v_{ac} = (L_1 + L_2)\frac{di}{dt}$$

The effective inductance of inductors in series is given by the sum of the inductances. Consider now two inductors in parallel.

$$L_{EQ} = \frac{1}{\frac{1}{L_1} + \frac{1}{L_2}}$$

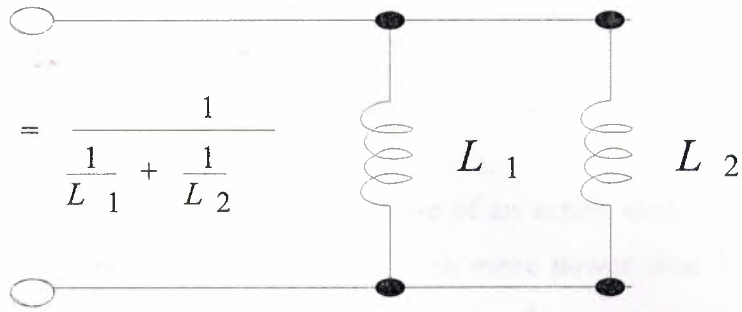


figure 2.1(f) inductor in parallel

The potential difference across each inductor is the same as they are connected to the same nodes. The current in each branch is different.

$$v_{ab} = L_1 \frac{di_1}{dt} = L_2 \frac{di_2}{dt}$$

$$but \ i_{total} = i_1 + i_2$$

$$\Rightarrow \frac{di_{total}}{dt} = \frac{di_1}{dt} + \frac{di_2}{dt}$$

$$= \frac{v_{ab}}{L_1} + \frac{v_{ab}}{L_2}$$

$$= v_{ab}\left(\frac{L_1 L_2}{L_1 + L_2}\right)$$

This is maybe intuitively clear as inductance is related to the current and the current through each inductor is now smaller as it has split into many branches.

2.2 Transistor

The transistor is the most important example of an **active element**. It is a device that can amplify and produce an output signal with **more power** than the input signal. The additional power comes from an external source i.e. the power supply.

The transistor is the essential ingredient of every electronic circuit: amplifiers, oscillators and computers. Integrated circuits (**ICs**), which have replaced circuits constructed from individual, discrete transistors, are themselves **arrays of transistors** and other components built as a single chip of semiconductor material.

A transistor is a 3-terminal device (Fig.1) available in 2 kinds: **npn** and **pnp** transistors.

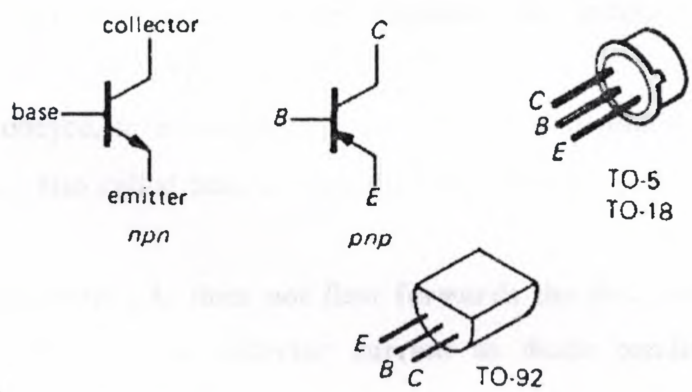


figure 2.2 (a) Transistor symbols and transistor packages.

The terminals are called: collector (C), base (B) and emitter (E). Voltage at a transistor terminal (relative to ground) is indicated by a single subscript, V_C is the collector voltage, for

instance. Voltage between 2 terminals is indicated by a double subscript: V_{BE} is base-to-emitter drop. If the same letter is doubled, it means power supply voltage: V_{CC} (positive) is power supply voltage associated with the collector and V_{EE} (negative) is power supply voltage associated with the emitter.

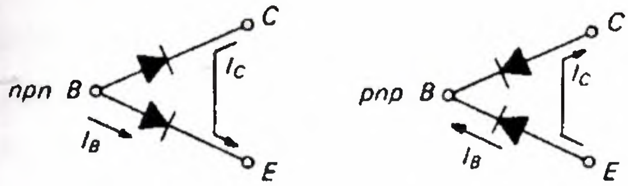


figure 2.2 (b) Direction of currents flow **npn** and **pnp** transistors.

The properties of **npn** transistors are:

1. The collector is more positive that the emitter.
2. The B-E and the B-C circuits behave like diodes (Fig.2): one of them is conducting and the other is polarized in the opposite direction.
3. Any transistor has maximum values of current and voltage, which can be applied without damage and costing the price of a new transistor (for instance, for general-purpose transistors I_C=200-500 mA, V_{CE}=20-40 V).
4. When 1-3 are obeyed, I_C is (roughly) proportional to I_B as follows: $I_C=h_{FE}I_B=\beta I_B$. The current gain h_{FE}, also called beta, is typically about $\beta=100$. Both I_C and I_B flow to the emitter.

Note: the collector current I_C does not flow forwards the B-C diode - it has reverse polarity. Do not think of the collector current as diode conduction. This is just "transistor action".

From the property 4 results: a small current flowing into the base controls a much larger (approximately 100 times larger) current flowing into the collector.

Note the result of property 2: the base is more positive than the emitter because of the forward diode drop, which is equal to about 0.6-0.8 V. An operating transistor has $V_B=V_E+V_{BE}$, V_{BE}=0.6-0.8.

When **pnp** transistor is considered, just reverse polarities normally given for **npn** transistor. Also characteristics are the same and the only difference is that direction of currents and voltages are opposed.

2.2.1 Typical, basic characteristics

U-I transistor characteristics are shown in Fig. 2a and Fig.2b. The characteristics show the following properties:

1. I_C almost does not depend on U_{CB} for fixed value of I_E . As long as I_E=constant, I_C does not change much when U_{CB} increases.
2. I_C almost does not depend on U_{CE} for fixed value of I_B . As long as I_B=constant, I_C does not change much when U_{CE} increases.
3. I_C is almost equal to I_E .

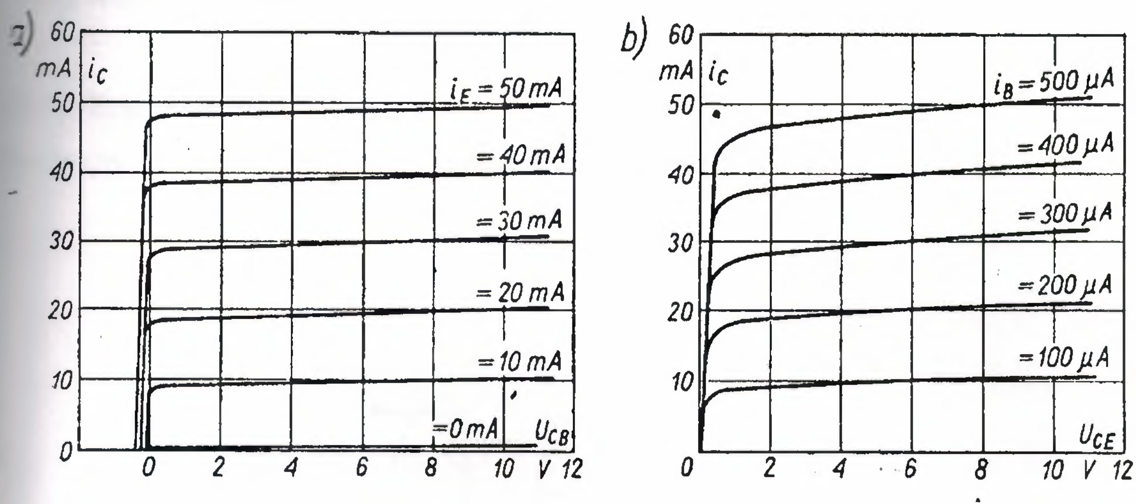


figure 2.2 (c) U-I transistor characteristics.

2.2.2 Some basic transistor circuits

- Transistor switch

Transistor switch example is shown in Fig.4.

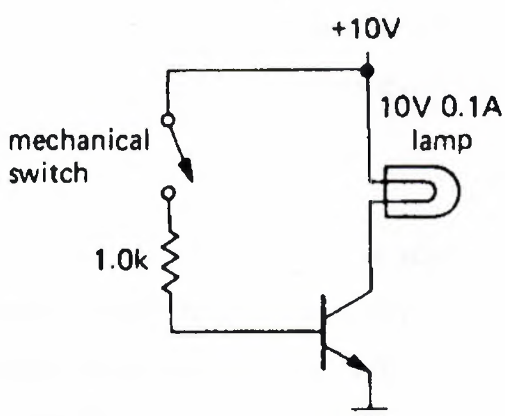


figure2.2 (d) Transistor switch circuit.

In this application, a small control current enables a much larger current in another circuit. How it works?

1. When the mechanical switch is opened, there is no base current, therefore (see rule 4) there is no collector current. The lamp is off.
2. When the mechanical switch is closed, the base rises to 0.6 volts (base-emitter diode is forward conducting, emitter is at ground voltage level).
3. As collector is more positive than the emitter is (see rule 1) the collector current enables the lamp to emit light.

2.2.3 Transistor man

The below cartoon will help you to understand principle of transistor operation.

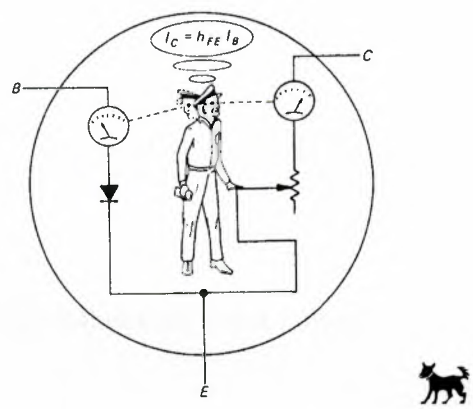


figure 2.2 (e) Transistor man observes the base current and adjust the adjustable resistor in an attempt to maintain the output current $\beta = h_{FE}$ times larger.

His only job is to try to keep $I_C = \beta I_B$ by means of adjustable resistor $\mathbf{R} = 0 \div \infty$. As the resistor can change from zero to infinity, thus he can go from a short circuit (saturation, large current flow) to an open circuit (transistor is in the "off" state, no current flow), or to anything in between. He is not allowed to use anything but the resistor.

At any given time, a transistor may be :

1. Cut off, **no collector current**.
2. In the active region, **some collector current** flows.
3. In saturation, almost constant **maximal collector current** flows.

2.2.4 Emitter follower

Fig.6 shows an example of an **emitter follower**.

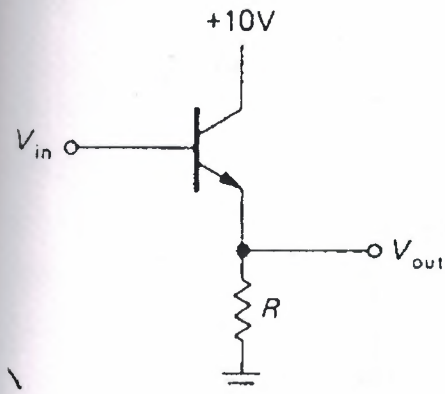


figure 2.2 (f) Emitter follower.

The output voltage (emitter) follows the input voltage (base), less one diode drop:

$V_E = V_B - 0.6$ volt.

The output is replica of the input, but 0.6 volt less positive. The main features:

i. Emitter follower has no voltage gain, but it has current gain, therefore it has power gain.

ii. The most important feature of emitter follower is that it has input resistance much larger than its output resistance.

This circuit requires less power from signal source to drive a receiver (a load) that it would be in case if the signal source drove the receiver (the load) directly.

In general the loading effect causes a reduction of signal (as you have discussed earlier).

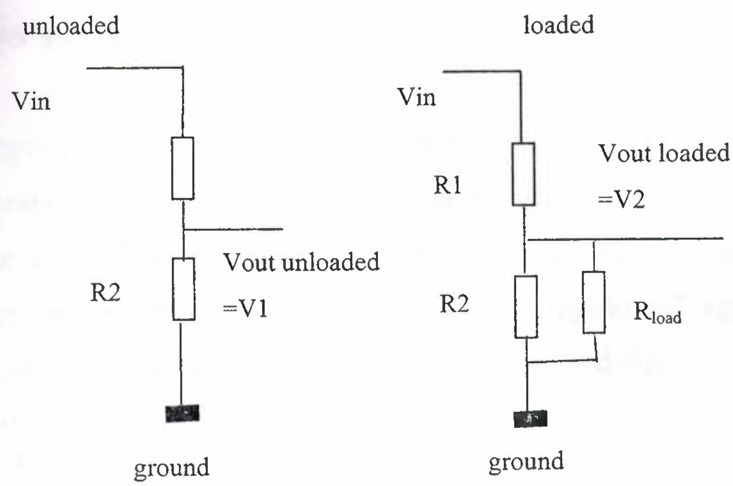


figure2.2(g) The effect of loading the source with R_{load} .

It is always required that V2=V1. It depends on how strongly R_{load} is loading the output. When $R_{load} \rightarrow$infinity, there is no loading and V2=V1, when $R_{load} \rightarrow 0$ there is extreme loading and V2=0 – no output signal at all. Therefore: the bigger R_{load} the better. What mathematics says?

Unloaded circuit:

$$V1 = I * R_2$$

$$I = \frac{V_{input}}{R_1 + R_2}$$

$$V1 = V_{input} \frac{R_2}{R_1 + R_2}$$

Loaded circuit:

$$V2 = I * R_{equivalent},$$

$$\text{where } R_{equivalent} = R_2 \| R_{load} = \frac{R_2}{R_2 / R_{load} + 1}$$

$$I = \frac{V_{input}}{R_1 + R_{equivalent}}$$

$$V2 = V_{input} \frac{R_2 \left(\frac{1}{1 + R_2 / R_{equivalent}} \right)}{R_1 + R_2 \left(\frac{1}{1 + R_2 / R_{equivalent}} \right)}$$

Conclusion: When $\mathbf{R}_{\mathbf{load}} \to \infty$, **then** $\mathbf{R}_{\mathbf{equivalent}} \to \mathbf{R}_2$ **and** $\mathbf{V}_2 \to \mathbf{V}_1$

The emitter follower is the circuit, which has $\mathbf{R}_{\mathbf{load}} \to \infty$.

Emitter follower as voltage regulator

The simplest regulated supply of voltage is a zener diode. The zener diode is an element for which the ratio V/I is not constant (as it is for resistance R) but it depends on particular value of V. It is important to know how the resulting zener voltage will change with applied current. This is a measure of its "regulation" against changes in driving curent provided to it. So called dynamic resistance is defined:

$$\mathbf{R}_{\mathbf{dyn}} = \frac{\Delta \mathbf{V}}{\Delta \mathbf{I}}$$

It has different value for different region of V-I characteristic:

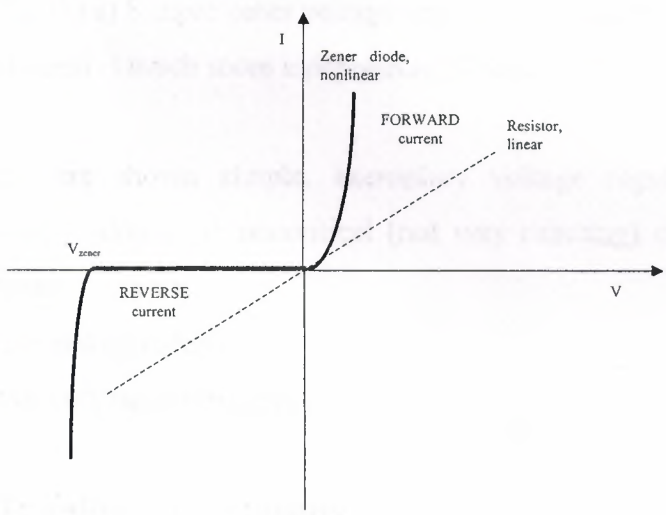
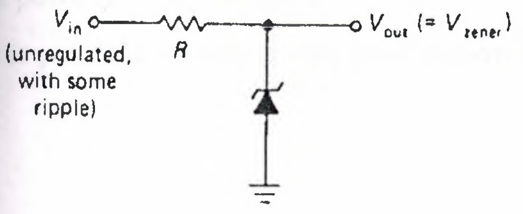


figure 2.2 (h) V-I curves for linear (resistor) and for nonlinear (zener diode) elements.

For a certain negative value of V (zener voltage, typical value 5V) the reverse current rapidly increases and $\mathbf{R}_{\mathbf{dyn}} = \frac{\Delta \mathbf{V}}{\Delta \mathbf{I}} \to 0$ (ideal case). Within 0 and V_{zener} the current is constant and $\mathbf{R}_{\mathbf{dyn}} = \frac{\Delta \mathbf{V}}{\Delta \mathbf{I}} \to \infty$ (ideal case). The zener voltage is specific for a diode. It does not depend on value of current (in reasonable limits) and is constant. Zener diodes with reverse current are able to keep constant zener voltage even if the reverse current changes its value.

a)



b)

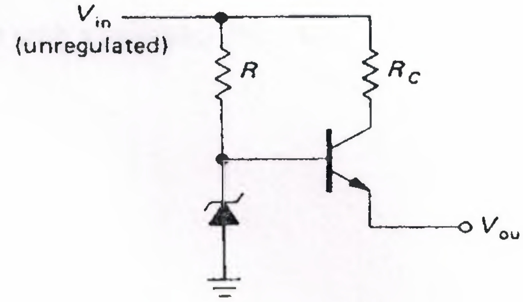


figure2.2 (k) a) Simple zener voltage regulator. b) Zener regulator with follower. Zener current is much more independent of load current.

In Fig.8 are shown simple, exemplary voltage regulator circuits. They can be successfully adopted in noncritical (not very exacting) circuits. However it has some limitations:

1. V_{out} is not adjustable.
2. Gives only moderate ripple rejection.

2.2.5 Transistor current source

The simplest approximation to a current source is shown in Fig. 9.

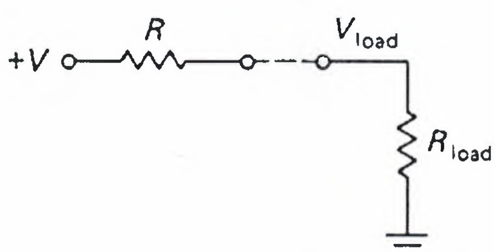


figure 2.2 (l). The simplest current source approximation.

As long as $R_{load} << R$ (which means $V_{load} << V$) the current I is nearly constant and is equal to I=V/R. The current does not depend on R_{load} therefore the circuit can be consider as

current source. The simplest solution has an inconvenience: in order to make good approximation of current source it is necessary to use large voltages. It causes lots of power dissipation in the resistor.

It is possible to make a very good current source with a transistor (Fig. 10).

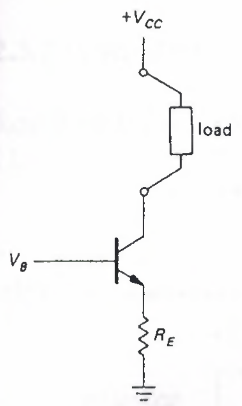


figure 2.2 (m) Transistor current source: basic concept.

$V_B>0.6$ volt applied to the base assures that the emitter is always conducting and $V_E=V_B-0.6$ volt. So:

$I_E = \frac{V_E}{R_E} = \frac{V_B - 0.6}{R_E}$. Let us notice that $I_E \cong I_C$ (see Fig. 3). Therefore $I_C \cong \frac{V_B - 0.6}{R_E}$

and it does not depend on V_C as long as the transistor is not saturated ($V_C>V_E+0.2$ volt). This is current source.

2.3 Resistance

A device that uses electrical energy is called a load. Loads always have some resistance; and a voltage drop across the, since V = E/Q. (If E↓, then V↓) Resistance describes the difficulty that electrons have moving through a material.All materials have resistance (except superconductors).Resistance is measured in Ohms, symbol Ω (omega).

2.3.1 What do resistors do?

Resistors limit current. In a typical application, a resistor is connected in series with an LED:

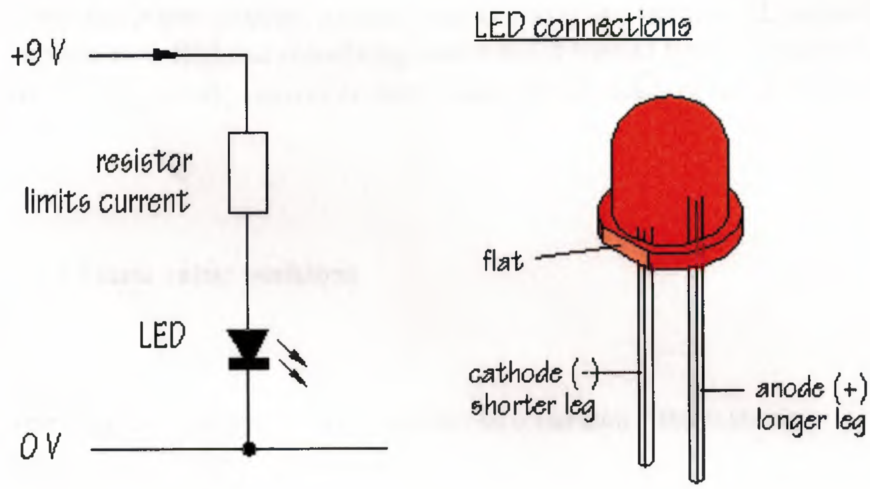
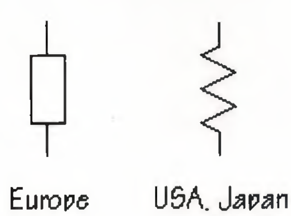


figure2.3 (a) connection of led

Enough current flows to make the LED light up, but not so much that the LED is damaged. Later in this Chapter, you will find out how to calculate a suitable value for this resistor.

The 'box' symbol for a fixed resistor is popular in the UK and Europe. A 'zig-zag' symbol is used in America and Japan:



Resistors are used with **transducers** to make **sensor subsystems**. Transducers are electronic components which convert energy from one form into another, where one of the forms of energy is electrical. A **light dependent resistor**, or **LDR**, is an example of an **input transducer**. Changes in the brightness of the light shining onto the surface of the LDR result in changes in its resistance. As will be explained later, an input transducer is most often connected along with a resistor to to make a circuit called a **potential divider**. In this case, the output of the potential divider will be a voltage signal which reflects changes in illumination.

Microphones and switches are input transducers. **Output transducers** include loudspeakers, filament lamps and LEDs. Can you think of other examples of transducers of each type?

In other circuits, resistors are used to direct current flow to particular parts of the circuit, or may be used to determine the voltage gain of an amplifier. Resistors are used with capacitors to introduce time delays.

Most electronic circuits require resistors to make them work properly and it is obviously important to find out something about the different types of resistor available, and to be able to choose the correct resistor value, in Ω, $k\Omega$, or $M\Omega$, for a particular application

2.3.2 Fixed value resistors

The diagram shows the construction of a **carbon film** resistor:

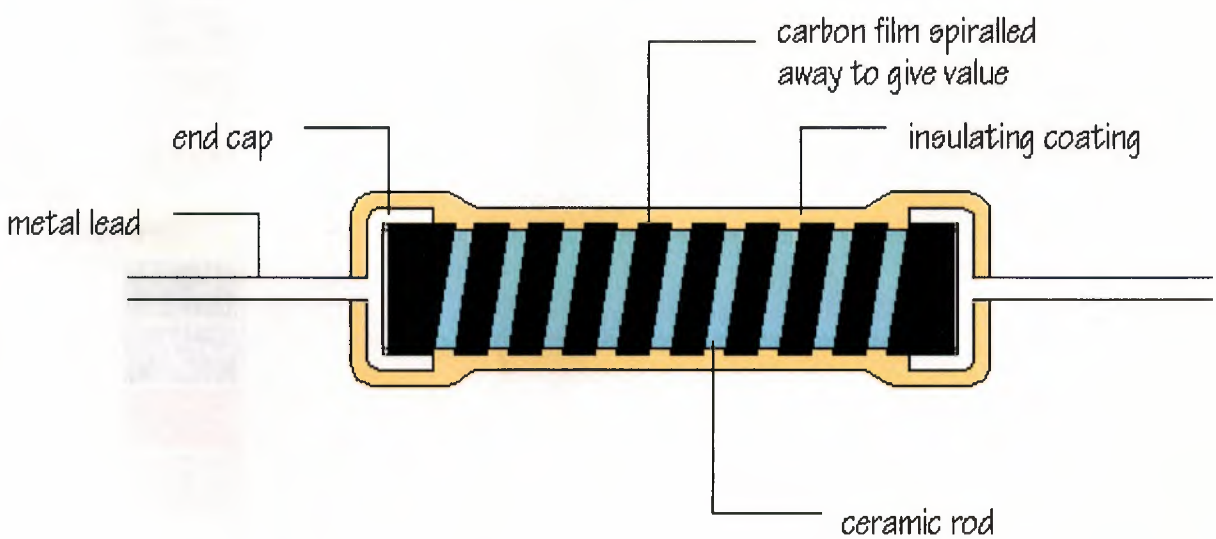


figure 2.3 (b) construction of carbon film resistor

During manufacture, a thin film of carbon is deposited onto a small ceramic rod. The resistive coating is spiralled away in an automatic machine until the resistance between the two ends of the rod is as close as possible to the correct value. Metal leads and end caps are added, the resistor is covered with an insulating coating and finally painted with coloured bands to indicate the resistor value.

Carbon film resistors are cheap and easily available, with values within ±10% or ±5% of their marked, or 'nominal' value. **Metal film** and **metal oxide** resistors are made in a similar way, but can be made more accurately to within ±2% or ±1% of their nominal value. There are some differences in performance between these resistor types, but none which affect their use in simple circuits.

Wirewound resistors are made by winding thin wire onto a ceramic rod. They can be made extremely accurately for use in multimeters, oscilloscopes and other measuring equipment. Some types of wirewound resistors can pass large currents wihtout overheating and are used in power supplies and other high current circuits.

2.3.3 Colour code

How can the value of a resistor be worked out from the colours of the bands? Each colour represents a number according to the following scheme:

Number	*Colour*
0	black
1	brown
2	red
3	orange
4	yellow
5	green
6	blue
7	violet
8	grey
9	white

figure 2.3 (c) colour representation

The first band on a resistor is interpreted as the FIRST DIGIT of the resistor value. Fo the resistor shown below, the first band is yellow, so the first digit is 4:

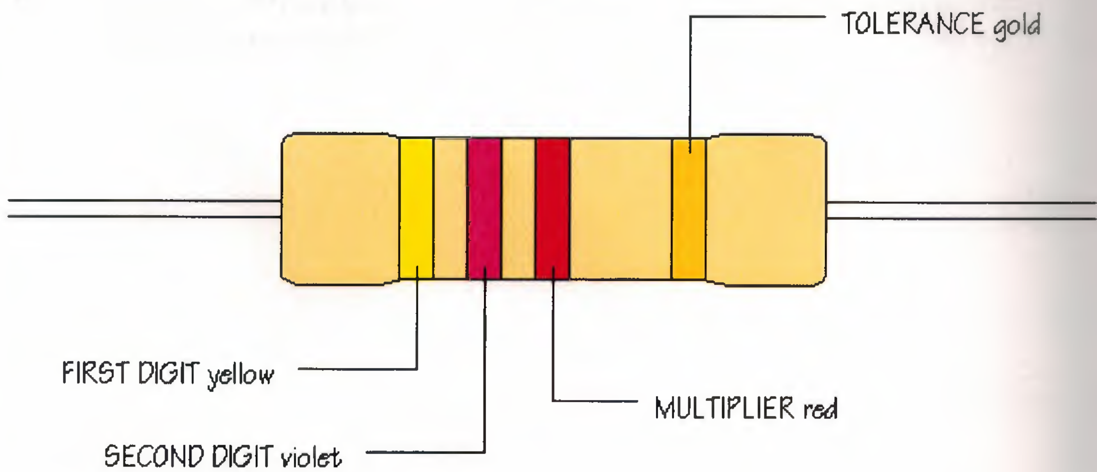


figure 2.3(d) represantation of resistor

The second band gives the SECOND DIGIT. This is a violet band, making the second digit 7. The third band is called the MULTIPLIER and is not interpreted in quite the same way. The multiplier tells you how many noughts you should write after the digits you already have. A red band tells you to add 2 noughts. The value of this resistor is therefore 4 7 0 0 ohms, that is, 4 700 Ω, or 4.7 $k\Omega$. Work through this example again to confirm that you understand how to apply the colour code given by the first three bands.

The remaining band is called the TOLERANCE band. This indicates the percentage accuracy of the resistor value. Most carbon film resistors have a gold-coloured toleran band, indicating that the actual resistance value is with + or - 5% of the nominal value. Other tolerance colours are:

Tolerance	*Colour*
±1%	brown
±2%	red
±5%	gold
±10%	silver

When you want to read off a resistor value, look for the tolerance band, usually gold, and hold the resistor with the tolerance band at its right hand end. Reading resistor values quickly and accurately isn't difficult, but it does take practice!

2.3.4 Resistors

Resistors, like diodes and relays, are another of the electrical components that should have a section in the installer's parts bin. They have become a necessity for the mobile electronics installer, whether it be for door locks, timing circuits, remote starts, or just to discharge a stiffening capacitor.

Resistors are components that resist the flow of electrical current. The higher the value of resistance (measured in ohms) the lower the current will be.

Resistors are color coded. To read the color code of a common 4 band 1K ohm resistor with a 5% tolerance, start at the opposite side of the GOLD tolerance band and read from left to right. Write down the corresponding number from the color chart below for the 1st color band (BROWN). To the right of that number, write the corresponding number for the 2nd band (BLACK) . Now multiply that number (you should have 10) by the corresponding multiplier number of the 3rd band (RED)(100). Your answer will be 1000 or 1K. It's that easy.

If a resistor has 5 color bands, write the corresponding number of the 3rd band to the right of the 2nd before you multiply by the corresponding number of the multiplier band. If you only have 4 color bands that include a tolerance band, ignore this column and go straight to the multiplier.

1K ohm resistor

The tolerance band is usually gold or silver, but some may have none. Because resistors are not the exact value as indicated by the color bands, manufactures have included a tolorance color band to indicate the accuracy of the resistor. Gold band indicates the resistor is within 5% of what is indicated. Silver = 10% and None = 20%. Others are shown in the chart below. The 1K ohm resistor in the example (left), may have an actual measurement any where from 950 ohms to 1050 ohms.

If a resistor does not have a tolerance band, start from the band closest to a lead. This will be the 1st band. If you are unable to read the color bands, then you'll have to use your multimeter. Be sure to zero it out first!

Resistor Color Codes

Band Color	1st Band #	2nd Band #	*3rd Band #	Multiplier x	Tolerances ± %
Black	0	0	0	1	
Brown	1	1	1	10	± 1%
Red	2	2	2	100	± 2 %
Orange	3	3	3	1000	
Yellow	4	4	4	10,000	
Gren	5	5	5	100,000	± 0.5 %
Blue	6	6	6	1,000,000	± 0.25 %
Violet	7	7	7	10,000,000	± 0.10 %
Grey	8	8	8	100,000,000	± 0.05 %
White	9	9	9	1,000,000,000	
Gold				0.1	± 5 %
Silver				0.01	± 10 %
None					± 20 %

2.4 The 555 Timer

The 555 timer chip introduced in the last chapter was configured as a free running astable multivibrator or oscillator. A different circuit allows the 555 timer chip to be configured as a monostable multivibrator or single pulse generator. In this configuration, the IC waits patiently for a trigger pulse which when received causes the output to change state for a fixed period of time related to an external capacitor and resistor, before returning to its initial state. The ability of the monostable to generate a single pulse of precise length is often referred to as a 'one shot' circuit element. Many times in digital electronics, a precise delay is required to allow events to be measured, data be displayed for a specific period of time or allow a timing pulse to catch up in order to synchronize events with the clock signal. The 555 monostable is a good solution.

One-shots are circuits that generate a fixed-length output pulse after receiving an appropriate trigger signal. The length of the output pulse is generally determined by the charging of a capacitor through an external resistor. A trigger or start signal sets the output on and initiates the charging cycle. When the voltage on the capacitor reaches an upper threshold level of two thirds of the supply voltage, the output is turned off and the capacitor voltage returns immediately to the initial voltage, zero. The circuit is now ready for another trigger pulse.

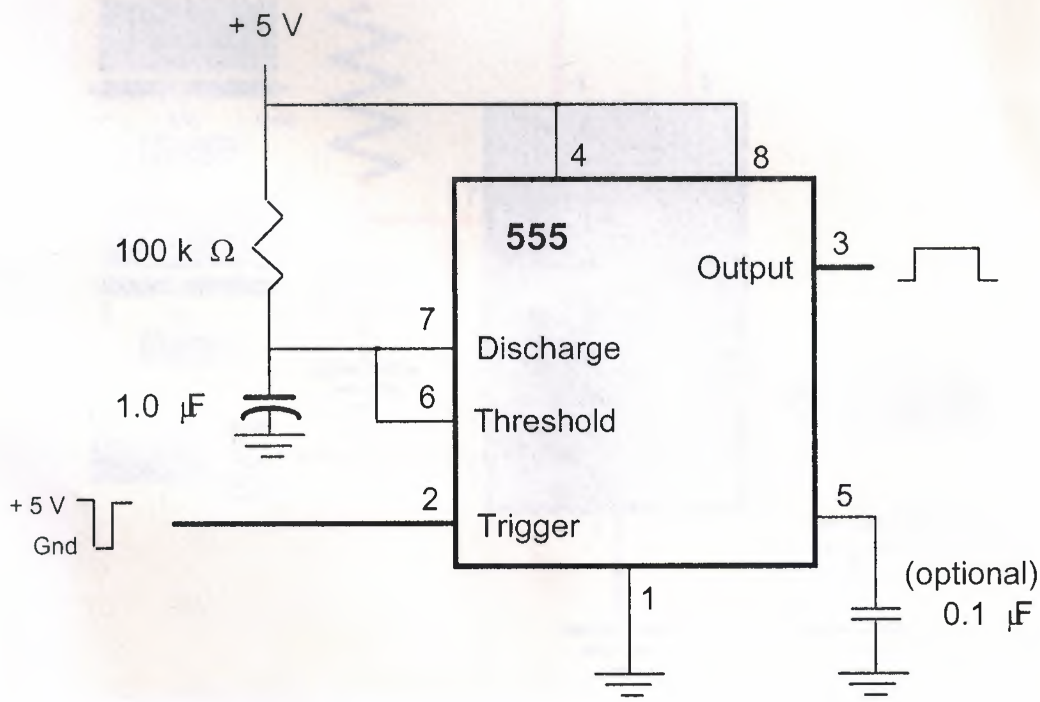


figure 2.4 (a) The 555 Timer IC configured as a Monostable Circuit

The monostable arrangement of components requires only a single resistor and capacitor. The voltage across the capacitor is sampled on pins 6 and 7. A negative trigger pulse on pin 2 sends the output (pin 3) high for a time determined by the resistor and capacitor network. When the capacitor voltage reaches the threshold (2/3 V_{cc}), the output goes low. The on-time T_{on} is given by

$$T_{on} = 1.1\ R\ C.$$

2.4.1 Operation of the 555 Monostable Circuit

Load the program called Monostable1.vi from the program library. Activate the circuit by clicking on the [Run] button. Click on the trigger switch to fire the monostable. Investigate the on-time by changing the external resistor and capacitor values.

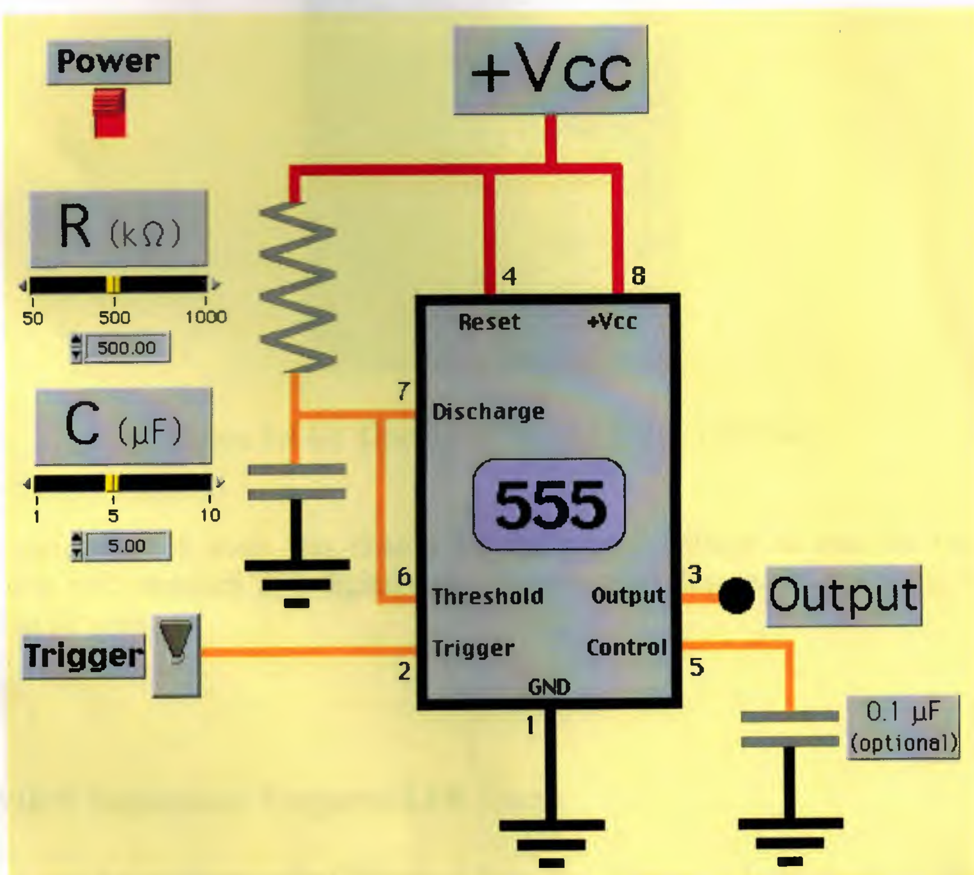


figure 2.4 (b) Simulation of a 555 Monostable Circuit

In general, the resistor can range from 1KΩ to 3.3MΩ and the capacitor from 500 pf to 10 μF. Thus the on-time can range from microseconds to hours.

The trigger input is normally high and momentarily bringing it low generates the trigger signal. It is important to remember that the trigger input must be brought high again after the triggered low state. For the 555 timer chip, the trigger pulse must be negative and narrower than T_{on}. Good design calls for a trigger pulse length about 1/4 T_{on} but shorter times often work well.

A graph of [Output vs Time] figure 2.4(c) displays the operation of the monostable more clearly. On triggering, the output pulse (shown in red trace) jumps to the high (positive) state and an internal transistor switch (at pin 7) opens to allow the capacitor to charge. The power supply charges the capacitor through the external resistor. The capacitor voltage (green trace) increases 'linearily' from 0 volts to 2/3 Vcc (yellow trace). At this point, the threshold comparator flips state and the internal transistor switch is closed forcing the capacitor to discharge and the output to return immediately to zero volts.

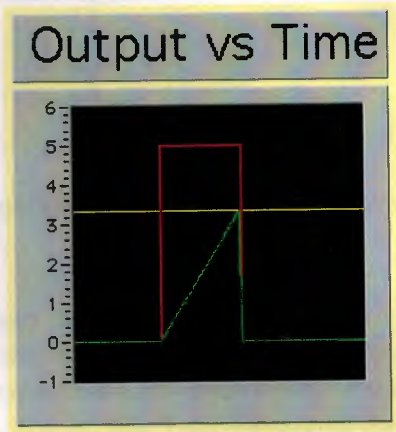


figure 2.4 (c) Display of the 555 timing voltages

In the simulation, 5 volts was chosen for the supply voltage so that the output is compatible with standard TTL digital chips. However the chip can be run at any voltage from 5 to 18 volts.

2.4.2 VIEW Simulation: Triggered LED Alarm

Load the program called Alarm.vi from the library. A light emitting diode has been added to the output of the 555 monostable circuit. Watch the LED turn on and off, when triggered by clicking on the switch. See the output voltage change and measure the on-time. After activating the circuit with the [Run] button, click on the trigger switch to generate a single pulse.

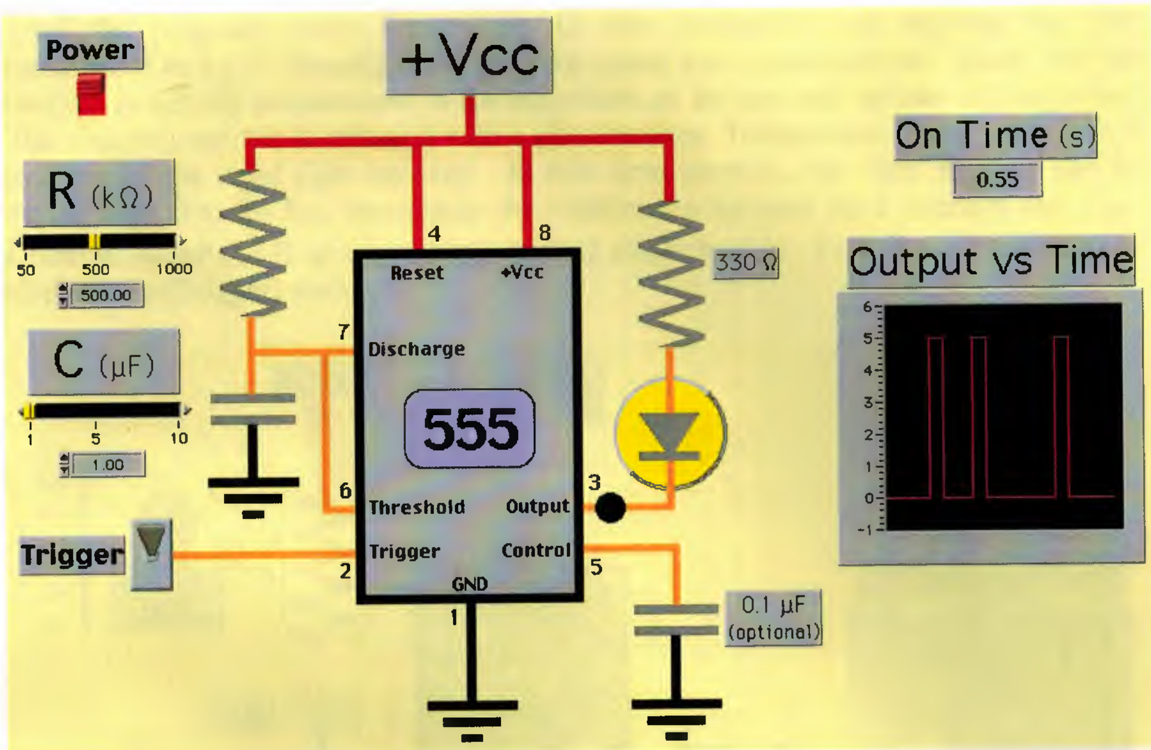


figure 2.4 (d) Simulation of a 555 Monostable with a LED Output

The LED is pulled high through a 330 Ω resistor whose magnitude was chosen to limit the current flowing through the LED. In the normal state, the output (pin 3) is low and current will pass through the LED and it will be on. When the output goes high, the LED turns off. A logic probe on pin 3 demonstrates the signal inversion of the LED pulled high.

Photoresistor Sensor

The resistance of a few semiconductors is strongly dependent on the amount of light impinging on the material. For these semiconductors, the energy gap is small enough so the photon energy can excite free carriers across the gap. The result is that current flowing through the sensor can be dramatically altered. The resistance of a typical photoresistor can change by six decades (1:1,ooo,ooo) in going from moonlight to sunlight. The resistance in absence of light, the so-called dark resistance is often in the megaohm region. As the light intensity increases, the resistance falls exponentially. In bright light the resistance is small, a few kilo-ohms or less. A plot of the device resistance versus light intensity displays an exponential variation. Plotting the device resistance as a function of the log of the light intensity displays a linear graph. On a logarithmic scale, the light intensity is measured in units of lux. Zero lux is no light while 10 lux corresponds to a bright flashlight beam. Cadmium selenide, a photoresistance material, has a wavelength or colour response close to that of the human eye. The eye is most responsive to the yellow. These devices make good photometers in photography applications.

VIEW Simulation: Photometer

Load the program called Photometer. In this simulation, one explores the 555 monostable as a light transducer (light is converted into a time interval). Recall that the on-time is directly proportional to the magnitude of the external resistor and capacitor. The charging resistor is replaced with a photoresistor. The on-time (1.1RC) is then a measure of the input light intensity . In this demonstration, the light intensity can be varied from 0 to 10 lux. Investigate the relationship between light intensity and T_{on}. Click and drag the [Light Intensity] vertical slider marker. To make a measurement click on the [Trigger] switch.

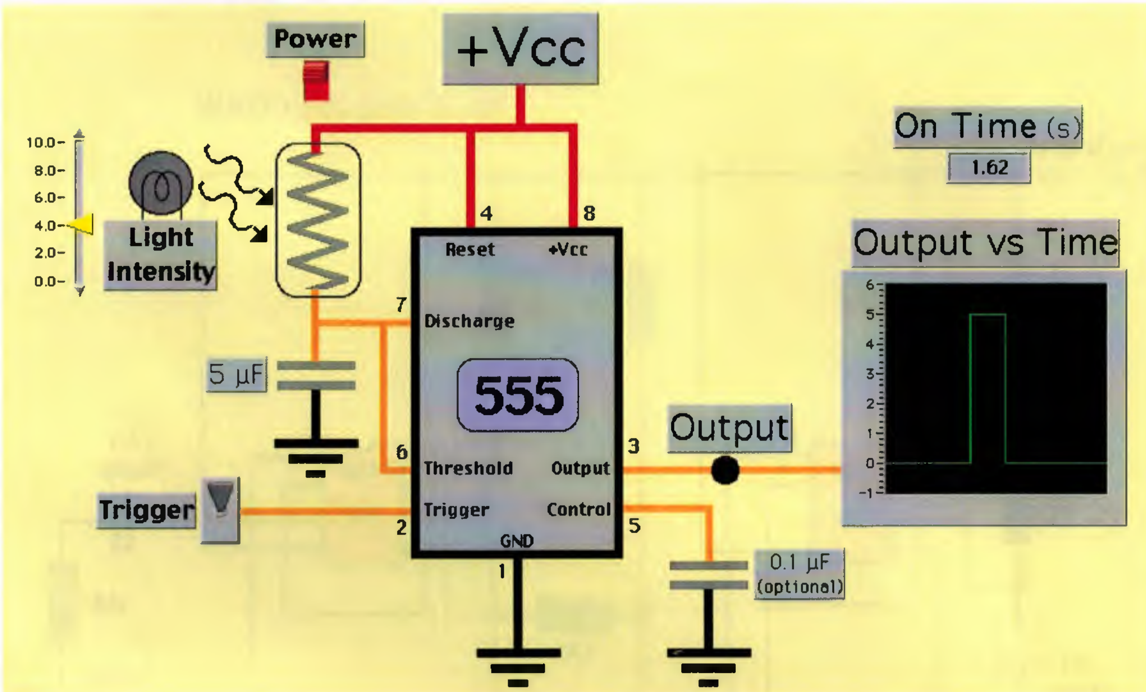


figure 2.4 (e) Simulation - Monostable Circuit to Measure Light Intensity

CHAPTER 3:

SAMPLES CİRCUİT

3.1 Wailing Alarm Siren

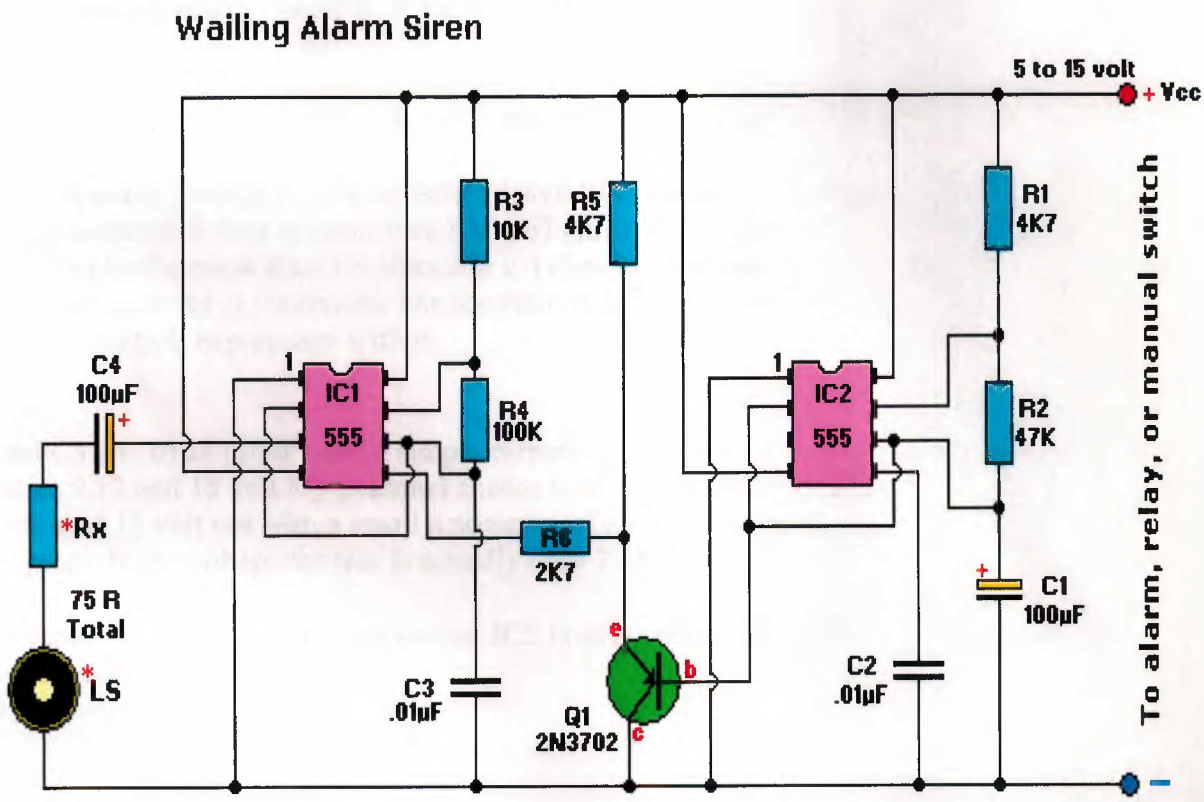


figure3.1(a) wailing alarm siren circuit

Part List

R1,R5 = 4.7 K	C1,C4 = 100 uF / 2.5 V electrolytic
R2 = 47 K	C2,C3 = 0.01uF , ceramic
R3 = 10 K	Q1 = 2N3702
R4 = 100 K	IC1, IC2 = LM 555, NE 555, uA 555
Rx =See text	LS = Loudspeaker

3.1.1 Working Principle

This circuit provides warbling sound to any alarm circuit.IC2 is wired as a low frequecy astable with cycle period of about 6second.The slowly varying ramp waveform aat C1 is fed to PNP emitter flower Q1,and is then used to frequency modulate alarm generator IC1 via R6.
IC1 has a natural center frequecy of about 800 Hz.

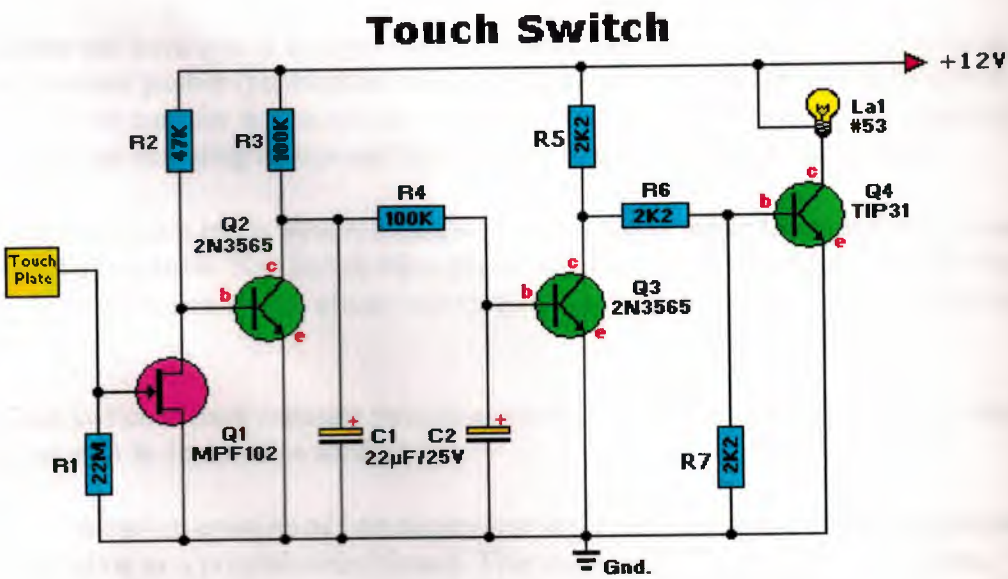
Circuit action is such that the alarmoutput signal starts at a low frequecy, rises for 3 second to a high frequecy,then falls over 3 seconds to a low again,and so on.

The loudspeaker LS and the the resistor marked 'Rx' should be together 75 ohms.If you have a started 8 ohm speaker then Rx is 67 ohms.The nearest value is 68 ohms.So far a 8 ohm loudspeaker Rxis 68 ohms.For a 4 ohm loudspeaker Rx is 71 ohms,a for 25 ohm loudspeaker Rx is 50ohm,etc.The Rx value is not very critical.It is just there as sort of volume control, experiment with it.

C2 and C3 are .01uF (10nF) and a simple ceramic type will do the job.I tested the circuit at 9,12,and 15 volt.My personel choice is the 9 volt alkaline type for battery operation,or 12 volt use with a small a powersupply.The so called 9V NİCad will not work properly the voltage for this is actually only 7.5V (6cells*1.2=7.5V)

Just in case you are wondering,output pin IC2 is not connected! In the prototype, I used LM 555 timers.

3.2 Touch Switch



Parts List:

Part	Description	Radio Shack #	DigiKey #	Notes
R1	22Meg resistor			red red green gold
R2	47K resistor			yellow purple orange gol
R3,R4	100K resistor			brown black yellow gold
R5,R6,R7	2K2 resistor			red red red gold
C1	Capacitor, 22µF, 25V			Electrolytic
C2	Capacitor, 22µF, 25V			Electrolytic
Q1	MPF102			Transistor, NPN
Q2,Q3	2N3565			Transistor, NPN
Q4	TIP31			Transistor, NPN
La1	Bulb, #53			Try others

3.2.1 Switching techniques:

Manual switches can have one or a combination of switching actions. In momentary-action switches, the operator pushes (pushbutton or toggle) or twists (rotary) the actuating device and contacts move to transfer the circuits to the second set of contacts. When the actuating force is removed, the actuating device and the contacts return to the original position.

When a maintained-action touch switch is actuated, the contacts move to transfer the circuits to the second set of contacts. No change takes place until the operator actuates the switch a second time. Then the touch switch circuit moves to another set of contacts or returns to the original position.

Mechanical-bail switches have separate switching assemblies, which are interlocked so that actuation of one switch deactivates another.

A capacitive touch switch consists of two conductive layers on opposite sides of an insulating material such as glass or a printed-circuit board. The touch switch has conductive layers, which create a capacitance that decreases when a layer is touched. Interface circuitry is used on a touch switch to convert the capacitance and change into a usable switching action to drive logic systems or to switch analog signals. There are several types of touch switch circuits available.

A membrane touch switch is a simple device in which conductive leads on the underside of a flexible membrane are, at a keystroke, pushed through a hole in a spacer to make contact with conductive leads on a base. Virtually every membrane touch switch can handle loads up to about 1.5 VA at 5 to 15 V.

Conclusion:

Sirens are sound making devices that alert people there is an emergency, weather there is a fire, an earthquake, a tornado, or police, or an ambulance is coming.

As technology advances some things become absolete, but without them we wouldn't have the things we have now. Some examples of inventions that lead the way to today's technology are how floppy disks, record players, and cassettes gave birth to CDs, DVDs, and portable flash drives.

However there are things that only can be improved not replaced. That is the case of sirens which started so long a go and today is even used in the production of music. Sirens use different amplitude and frequency to produce different sounds depending in the organization. Sirens are also used for protection for homes, buildings and automobiles and to make sure equipment are functioning properly.

I believe that we can improve the functionality of sirens in emergency situations,by implementing different techniques especially for modern fire engines by equipping emergency vehicles with both types of sirens, electronic and pneumatic

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