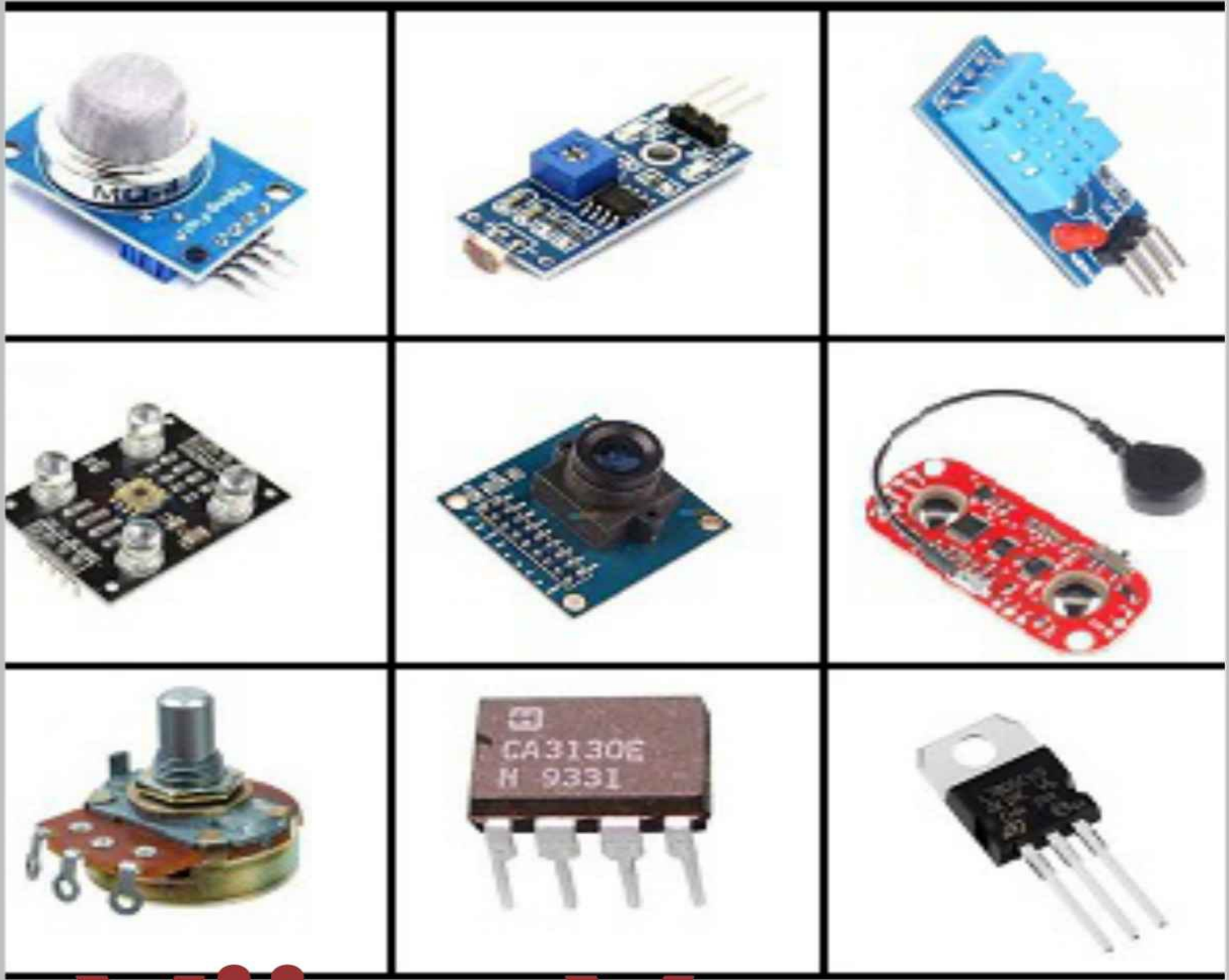
Electronics Components

All Sensors & Components Used With Arduino



Vijay Verma

Electronic Components

(All Sensors, Basic Components, and other Important Components Used with Arduino)

In this book, complete information about important electronics components is given. which we use with Arduino. Most of the sensors details are given in this book. All the sensors we use with the Arduino. And some basic components details are also given in it, which all students should know about.

Author
Vijay Verma
(Programmer & Projects Designer)
(I have been working on Arduino based projects for 5 years)

Dedicate

This book is for all students, because it contains the most important electronics components details. Which all students should know about, because students continue to need these components. If any student keeps experimenting at home or at school, then it is very important to know about these components. So that they can do their work easily.

NOTE- And those who want to do shows in school and college exhibition by creating student projects, So they too should know about all these electronics components so that they can make their project easily.

Introduction

In this book, complete information about important electronics components is given. which we use with Arduino. Most of the sensors details are given in this book. All the sensors we use with the Arduino. All the components are given in this book. Along with his image his basic details are also given, By which any student can easily understand about the components.

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Part-1

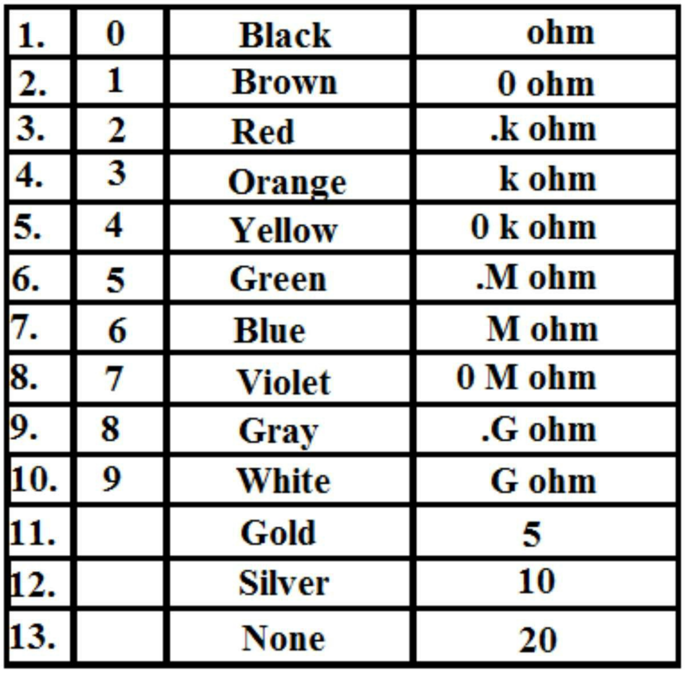
1. All Basic Components Details

Resistance

Resistance is a measure of the opposition to current flow in an electrical circuit. Resistance is measured in ohms, symbolized by the Greek letter omega (Ω). Ohms are named after Georg Simon Ohm (1784-1854), a German physicist who studied the relationship between voltage, current and resistance.

Resistance is the opposition that a substance offers to the flow of electric current of one ampere passes through component across which a potential difference (voltage) of one volt exits. Then the resistance of that component is one ohm.

Colour Band



1.	0	Black	ohm
2.	1	Brown	0 ohm
3.	2	Red	.k ohm
4.	3	Orange	k ohm
5.	4	Yellow	0 k ohm
6.	5	Green	.M ohm
7.	6	Blue	M ohm
8.	7	Violet	0 M ohm
9.	8	Gray	.G ohm
10.	9	White	G ohm
11.		Gold	5
12.		Silver	10
13.		None	20

10 OHM Resistance-

10 ohm Resistance, 1/4W Rating Power, 250V Withstand Voltage, +/-5% **Resistance** Tolerance, Carbon Film **Resistors**. The carbon film **resistor** with wire leads for through-hole mounting.

10R / 10 ohm Resistor Colour Code

Value	**10 Ω**
Type	4 Band Colour Code
Colour Code	**Brown**, **Black**, **Black**, **Gold**
Multiplier	**Black**, 1

Tolerance	**Gold** Band ±5%

100 OHM Resistance-

A resistor is a passive two-terminal electrical component that implements electrical resistance as a circuit element. ... In electronic circuits, resistors are used to limit current flow, to adjust signal levels, bias active elements, and terminate transmission lines among other uses.

4-band 100 ohm resistor color code is calculated as:

1st-band= Brown= 1 (1st digit) 2nd-band= Black= 0 (2nd digit) 3rd-band= Brown= 1 (multiplier) = 10^1 = 10. 4th-band= Gold= ±5% (tolerance)

1k OHM Resistance-

A resistor is a **passive** two-terminal electrical component that implements electrical resistance as a circuit element. In electronic circuits, resistors are used to reduce current flow, adjust signal levels, to **divide** voltages, bias active elements, and terminate transmission lines, among other uses.

1k0 / 1k ohm Resistor Colour Code

Value	**1 kΩ / 1000 Ω**
Type	4 Band Colour Code
Colour Code	Brown, Black, Red, Gold
Multiplier	Red, 100

Tolerance	Gold Band ±5%

10k OHM Resistance-

1/6th Watt, +/- 5% tolerance PTH **resistors**. Commonly used in PCBs and perf boards, these **10K resistors** make excellent pull-ups, pull-downs, and current limiters. Because of the thin leads we don't recommend them for breadboards.

10k / 10k ohm Resistor Colour Code

Value	**10 kΩ**
Type	4 Band Colour Code
Colour Code	**Brown**, **Black**, **Orange**, **Gold**
Multiplier	**Orange**, 1000
Tolerance	**Gold** Band ±5%

47k OHM Resiatnce-

47K Ohm 1W MOR MOF RSF Series with ±5% Tolerance, General Purpose Metal Oxide Film Resistors. 47K Ohm Resistor Color Code: Yellow, Violet, Orange, Golden. Approximate Max Current: 4.613mA.

47k / 47k ohm Resistor Colour Code

Value	**47 kΩ / 47000 Ω**
Type	4 Band Colour Code System
Colour Code	**Yellow**, **Violet**, **Orange**, **Gold**

Multiplier	**Orange**, 1000
Tolerance	**Gold** Band ±5%

680 OHM Resistance-

680 Ohm 1W High Quality Carbon Film **Resistor** (CFR) with ±5% Tolerance and Tin Plated Copper Leads. **680 Ohm Resistor** Color Code: Blue, Gray, Brown, Golden. Approximate Max Current: 38.348mA.

100k OHM Resistance-

100K Ohm 1W High Quality Carbon Film **Resistor** (CFR) with ±5% Tolerance and Tin Plated Copper Leads. **100K Ohm Resistor** Color Code: Brown, Black, Yellow, Golden. Approximate Max Current: 3.162mA.

220 OHM Resistance-

A gold **tolerance** band is 5% **tolerance**, silver is 10%, and no band at all would mean a **20**% **tolerance**. For example: A **220** Ω **resistor has** a silver **tolerance** band.

220R / 220 ohm Resistor Colour Code

Value	**220 Ω**
Type	4 Band Colour Code System
Colour Code	**Red**, **Red**, **Brown**, **Gold**
Multiplier	**Brown**, 10
Tolerance	**Gold** Band ±5%

220k OHM Resistance-

220K Ohm 1W High Quality Carbon Film Resistor (CFR) with ±5% Tolerance and Tin Plated Copper Leads. 220K Ohm Resistor Color Code: Red, Red, Yellow, Golden. Resistance: 220K Ohm, Power Rating: 1 Watt, Approximate Maximum Current: 2.13mA .

4.7k OHM Resistance-

Let's take an example of a 5-band resistor with the colors given in the above image (brown, green, red, black and gold). So according to the formula the resistance will be: 152 * 1 = 152 Ohms with 5% tolerance.

68k OHM Resistance-

68K Ohm 0.5W Carbon Film Resistor (CFR) with ±5% Tolerance. 68K Ohm Resistor Color Code: Blue, Gray, Orange, Golden. Resistance: 68K Ohm, Power Rating: 0.5 Watt, Approximate Maximum Current: 2.71mA .

330 OHM Resistance-

330 ohm resistor color code for 4-band is calculated as:

(1st digit) = Orange = 3. (2nd digit) = Orange = 3. (multiplier) = Brown = 1 = 10^1 = 10. (tolerance) = Gold= ±5%

270 OHM Resistance-

270 Ohm Resistor Color Code: Red, Violet, Black, Black, Brown. **Resistance**: **270 Ohm**, Power Rating: 0.5 Watt, Approximate Maximum Current: 43.03mA .

Preset

A preset resistor is a smaller PCB mounted version of a potentiometer. These are useful where adjustment or configuration of a circuit needs to be made but such adjustment only occurs during building a circuit, not during normal use. An appropriate value for the PICAXE system is 10k (do not use 100k devices).
A preset is a three legged electronic component which can be made to offer varying resistance in a circuit. ... Such variable resistors are commonly used for adjusting sensitivity along with a sensor.
It can act as a control on the amount of current flowing. Here is a picture of a variable resistor from a dimmer switch. A variable resistor works by adjusting the path that current has to flow. Inside the resistor is a strip of metal or conducting ceramic which is connected to one part of the circuit.

100 OHM Preset-

100 Ohm Single Turn Preset - Variable Resistor - RM065

Rated Power: 100mW (0.1w), Resistance Tolerance:±20%.

1k OHM Preset-

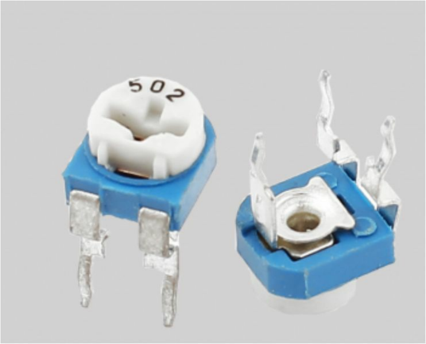
The variable resistors are used for variating voltage as per the need in a circuit. The outer two pins are connected to Vcc and 0V, and center pin outputs a variable voltage between 0V and Vcc as the potentiometer is rotated.

2k OHM Preset-

Full Power Rating Temperature: 85°C. Lead Diameter: 0.5mm.
Operating Temperature Range: -55°C to +125°C. Resistance: 2Kohm.

5k OHM Preset-

Full Power Rating Temperature: 85°C. Lead Diameter: 0.5mm. Operating Temperature Range: -55°C to +125°C. Resistance: 5Kohm.



10k OHM Preset-

A preset resistor is a smaller PCB mounted version of a potentiometer. These are useful where adjustment or configuration of a circuit needs to be made but such adjustment only occurs during building a circuit, not during normal use. An appropriate value for the PICAXE system is 10k (do not use 100k devices).

50k OHM Preset-

The variable resistors are used for variating voltage as per the need in a circuit. The outer two pins are connected to Vcc and 0V, and center pin outputs a variable voltage between 0V and Vcc as the potentiometer is rotated.

100k OHM Preset-

The maximum resistance that a preset can provide is written on it. If 100K is written on preset, it means that we can vary its resistance from 0 Ohm to 100K. A movable metal is rotated in clockwise or anticlockwise direction that changes the resistance of preset.

Capacitor

A capacitor is a device that stores electrical energy in an electric field. It is a passive electronic component with two terminals. The effect of a capacitor is known as capacitance. ... Capacitors are widely used as parts of electrical circuits in many common electrical devices.

A capacitor is a passive two-terminal electronic component that stores electrical energy in an electric field. The effect of a capacitor is known as capacitance. While some capacitance exists between any two electrical conductors in proximity in a circuit, a capacitor is a component designed to add capacitance to a circuit. The capacitor was originally known as a condenser or condensator.

0.01 microfarad Capacitor-

Ceramic Disc **Capacitor 10nF**. The marking on these **capacitors** is 103Z. Z refers to the dielectric type. 103 is the **capacitance** value in picofarads (pF) where this is read as 1,0, followed by three zeros. 0.01uF = **10nF** = 10,000pF.

0.1 microfarad Capacitor-

Max voltage: 50V. Radial Lead(pin) spacing: 5.08mm (0.2in) Radial Size: 5.08mm(0.2in) x 13mm(0.51in) (width x length including pins) ... Axial Size: 7.6mm (0.3in) x 11mm(0.43in) (width x length including pins).

10 Microfarad Capacitor-

A ten micro-Farad capacitor is written as 10µF or 10uF. A one-hundred nano-Farad capacitor is written as 100nF or just 100n. It may be marked as 0.1 (meaning 0.1uF which is 100nF). Or it may be marked with 104, meaning 10 and four zeros: 100000pF which is equal to 100nF.

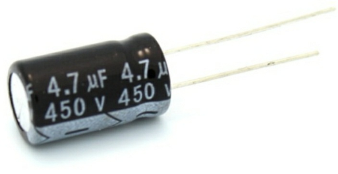
100 microfarad Capacitor-

Electrolytic decoupling capacitors 100uF/25V. These capacitors are great transient/surge suppressors. Attach one between the power and ground of your project to ensure smooth power delivery. High quality radial electrolytic capacitors.

1000 microfarad Capacitor-

This is a 1000uf 16 volts radial polarised good quality Electrolytic capacitor. Electrolytic capacitors are widely used in power supplies, switched-mode power supplies and DC-DC converters. This capacitor has long life, low leakage current and wide operating range.

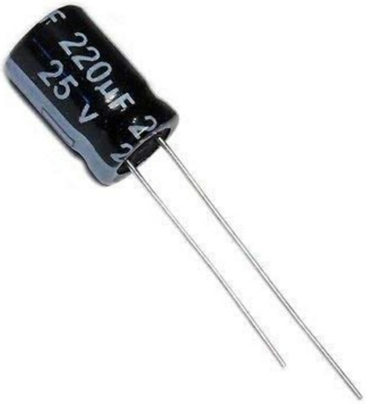
4.7 microfarad Capacitor-



220 Microfarad Capacitor-

220 mF Model of the Supercapacitor DMT Series

Supercapacitors (EDLCs) are energy storage devices with longer lifetime than batteries and higher capacitance than what is typically found in conventional capacitor technology, such as ceramic capacitors or electrolytic capacitors.



2.2 Microfarad Capacitor-

Features of **2.2 uf**/50v electrolytic **capacitor**: type: electrolytic. Operating voltage: 50v. **Capacitance**: **2.2 uf**. Applications of **2.2 uf**/50v electrolytic **capacitor**: noise filteration.

Transistor

A transistor is a semiconductor device used to amplify or switch electronic signals and electrical power. It is composed of semiconductor material usually with at least three terminals for connection to an external circuit. A voltage or current applied to one pair of the transistor's terminals controls the current through another pair of terminals. Because the controlled (output) power can be higher than the controlling (input) power, a transistor can amplify a signal. Today, some transistors are packaged individually, but many more are found embedded in integrated circuits.

Transistor BC547-

BC547 is an NPN bi-polar junction transistor. A transistor, stands for transfer of resistance, is commonly used to amplify current. A small current at its base controls a larger current at collector & emitter terminals. ... Its equivalent transistors are BC548 and BC549.

Transistor BC548-

The BC548 is a general-purpose NPN bipolar junction transistor commonly used in European and American electronic equipment. It is notably often the first type of bipolar transistor hobbyists encounter and is often featured in designs in hobby electronics magazines where a general-purpose transistor is required.

Transistor BC557-

BC557 is a PNP transistor hence the collector and emitter will be closed (Forward biased) when the base pin is held at ground and will be opened (Reverse biased) when a signal is provided to base pin.

Transistor BC558-

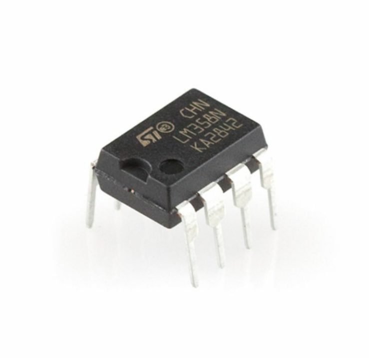
BC558 is a general purpose PNP transistor. It is used in switching and amplifier applications. The DC current gain varies in range 110 to 800. ... For switching applications,transistor is biased so that it remains fully on if there is a signal at its base.

IC(Integrated circuit)

Integrated circuit (**IC**), also called microelectronic circuit, microchip, or chip, an assembly of electronic components, fabricated as a single unit, in which miniaturized active devices (e.g., transistors and diodes) and passive devices (e.g., capacitors and resistors) and their interconnections are built up on a thin

IC358-

The LM358 IC is a great, low power and easy to use dual channel op-amp IC. It is designed and introduced by national semiconductor. It consists of two internally frequency compensated, high gain, independent op-amps. This IC is designed for specially to operate from a single power supply over a wide range of voltages. The LM358 IC is available in a chip sized package and applications of this op amp include conventional op-amp circuits, DC gain blocks and transducer amplifiers. LM358 IC is a good, standard operational amplifier and it is suitable for your needs. It can handle 3-32V DC supply & source up to 20mA per channel. This op-amp is apt, if you want to operate two separate op-amps for a single power supply. It's available in an 8-pin DIP package.

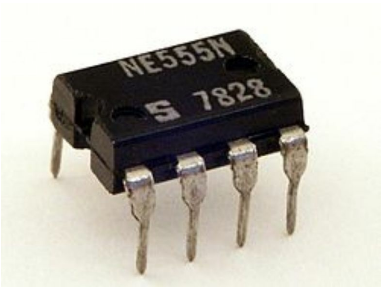


IC386-

The LM386 is a low power audio frequency amplifier which is very commonly used in small audio amplifiers. The **IC** consumes very less power and hence can be operated using a 9V battery easily. It can easily drive an 8-ohm speaker with a variable gain of 20 to200. Volume control and gain control is also possible in this.

IC555-

The 555 timer IC is an integrated circuit (chip) used in a variety of timer, pulse generation, and oscillator applications. The 555 can be used to provide time delays, as an oscillator, and as a flip-flop element. Derivatives provide two (556) or four (558) timing circuits in one package.



IC4017-

Most of us are more comfortable with 1, 2, 3, 4… rather than 001, 010, 011, 100. We mean to say that we will need a decimal coded output in many cases rather than a raw binary output. We have many counter ICs available but most of them produce binary data as an output. We will again need to process that output by using decoders or any other circuitry to make it usable for our application in most of the cases.

Let us now introduce you a new IC named IC 4017. It is a CMOS decade counter cum decoder circuit which can work out of the box for most of our low range counting applications. It can count from zero to ten and its outputs are decoded. This saves a lot of board space and time required to build our circuits when our application demands using a counter followed by a decoder IC. This IC also simplifies the design and makes debugging easy.

IC UM66-

UM66 is a melody generating **IC** commonly used in calling bell, phone, toys, musical bell in doors, home security alarm systems, burglar alarms etc. It is a three pin **IC** looks like a transistor. Its first pin is ground, second is VCC and the third is the melody output.

IC3130-

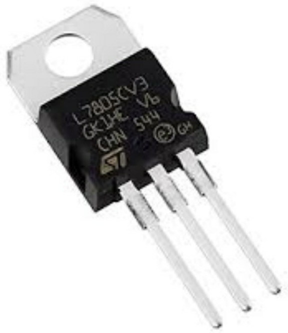
CA3130A and CA3130 are op amps that combine the advantage of both CMOS and bipolar transistors. Gate-protected P-Channel MOSFET (PMOS) transistors are used in the input circuit to provide very-high-input impedance, very-low-input current, and exceptional speed performance.

IC3140-

The CA3140 is a 4.5MHz, BiMOS Operational Amplifier with MOSFET Input/Bipolar Output that combines the advantages of high voltage PMOS transistors with high voltage bipolar transistors on a single monolithic chip.

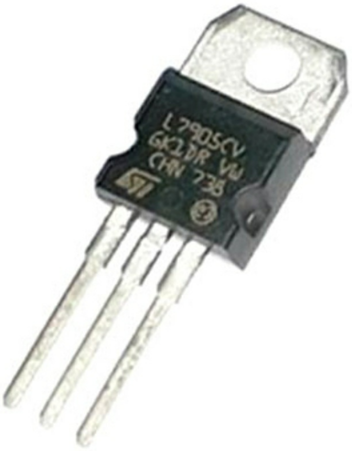
IC7805-

7805 is a three terminal linear voltage regulator **IC** with a fixed output voltage of 5V which is useful in a wide range of applications. Currently, the **7805** Voltage Regulator **IC** is manufactured by Texas Instruments, ON Semiconductor, STMicroelectronics, Diodes incorporated, Infineon Technologies, etc.



IC7905-

In our case the **7905 IC** is an negative 5V regulator, meaning it provides -5V as output. The name **7905** signifies two meaning, “79” means that it is a negative voltage regulator and “05” means that it provides 5V as output. So our **7905** will provide a -5V output voltage.



IR LED-

IR LED stands for “Infrared Light Emitting Diode”, they allows to emit light with the wavelength of up to 940nm, which is the infrared range of electromagnetic radiation spectrum. The wavelength range varies from 760nm to 1mm. ... The semiconductor material used to make these LEDs are gallium arsenide or aluminum arsenide.

Photodiode-

A **photodiode** is a semiconductor device that converts light into an electrical current. The current is generated when photons are absorbed in the **photodiode**. **Photodiodes** may contain optical filters, built-in lenses, and may have large or small surface areas. ... A **photodiode** is designed to operate in reverse bias.

Diode 1N4007-

1N4007 is a rectifier diode, designed specifically for circuits that need to convert alternating current to direct current. It can pass currents of up to 1 A, and have peak inverse voltage (PIV) rating of 1,000 V. Note: This product has a minimum quantity restriction (10nos) for order.

Zener Diode-

A **Zener diode** is a silicon semiconductor device that permits current to flow in either a forward or reverse direction. ... Additionally, the voltage drop across the **diode** remains constant over a wide range of voltages, a feature that makes **Zener diodes** suitable for use in voltage regulation.

LDR-

A Light Dependent Resistor (**LDR**) is also called a photoresistor or a cadmium sulfide (CdS) cell. ... It is basically a photocell that works on the principle of photoconductivity. The passive component is basically a resistor whose resistance value decreases when the intensity of light decreases.

Potentiometer-

A **potentiometer** is a three-terminal resistor with a sliding or rotating contact that forms an adjustable voltage divider. ... If only two terminals are used, one end and the wiper, it acts as a variable resistor or rheostat.

Condenser Microphone-

Condenser microphones use a pair of charged metal plates, one fixed (the back plate) and one movable (the diaphragm), forming a capacitor. When a sound wave hits the diaphragm, the distance between the two plates changes which produces a change in an electrical characteristic called capacitance.

8 OHM Speaker-

The purpose of **speaker** is to produce audio output that can be heard by the listeners. ... Like this **speaker** has **8 ohms** of impedance and comes with a power handling capacity of 1W.

LEDs-

In the simplest terms, a light-emitting diode (**LED**) is a semiconductor device that emits light when an electric current is passed through it. Light is produced when the particles that carry the current (known as electrons and holes) combine together within the semiconductor material.

Buzzer-

A buzzer or beeper is an audio signalling device, which may be mechanical, electromechanical, or piezoelectric (piezo for short). Typical uses of buzzers and beepers include alarm devices, timers, and confirmation of user input such as a mouse click or keystroke.

9 volt Battery Cap-

This simple cable has so many uses! Plug the battery clip onto a standard 9V battery and connect the other end to any device that needs 9V. The Connector leads are polarity color coded, Red and Black.

9 volt Battery-

The **nine-volt battery**, or **9-volt battery**, is a common size of **battery** that was introduced for the early transistor radios. It has a rectangular prism shape with rounded edges and a polarized snap connector at the top. This type is commonly used in walkie-talkies, clocks and smoke detectors.

PCB

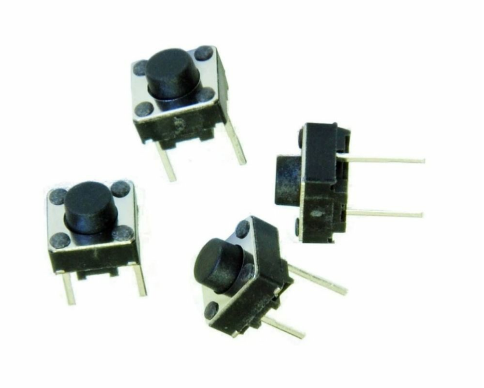
Transformer 6-0-6-

Transformer has 240 V primary windings and centre tapped secondary winding. The **transformer** has flying colored insulated connecting leads (Approx 100 mm long). The **Transformer** act as step down **transformer** reducing AC - 240V to AC - 6V. The **Transformer** gives two outputs of 12V, 6V and 0V.

Switch-

Wire-

Push Button-



Part-2

2. All Sensors Details

PIR Sensor-

PIR sensors allow you to sense **motion**, almost always used to detect whether a human has moved in or out of the **sensors** range. They are small, inexpensive, low-power, easy to use and don't wear out. ... They are often referred to as **PIR**, "Passive Infrared", "Pyroelectric", or "IR **motion**" **sensors**

a. How does a PIR motion sensor work?

A passive infrared **sensor** (**PIR sensor**) is an electronic **sensor** that measures infrared (IR) light radiating from objects in its field of view. They are most often used in **PIR-**based **motion detectors**. ... They **work** entirely by detecting infrared radiation (radiant heat) emitted by or reflected from objects

b. What is the output of PIR sensor?

It has a built-in voltage regulator so it can be powered by any DC voltage from 4.5 to 12 volts, typically 5V is used. Other than this, there are a couple options you have with your **PIR**

IR Sensor-

IR sensor is an electronic device, that emits the light in order to sense some object of the surroundings. An **IR sensor** can measure the heat of an object as well as detects the motion. Usually, in the **infrared** spectrum, all the objects radiate some form of thermal radiation.

a. How does the IR sensor work?

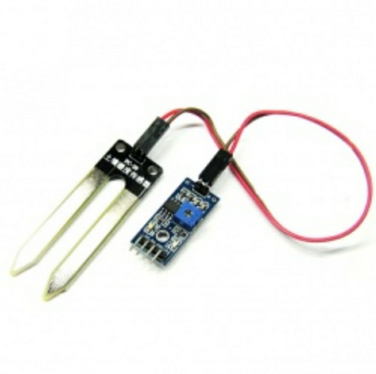
Active **infrared sensors** both emit and detect **infrared** radiation. ... When an object comes close to the **sensor**, the **infrared** light from the LED reflects off of the object and is detected by the **receiver**. Active **IR sensors** act as proximity **sensors**, and they are commonly used in obstacle detection systems (such as in robots).

b. What is the output of IR sensor?

IR detectors are digital out - either they detect 38KHz **IR** signal and **output** low (0V) or they do not detect any and **output** high (5V). Photocells act like resistors, the resistance changes depending on how much light they are exposed to.

Soil Moisture Sensor-

The **Soil Moisture Sensor** uses capacitance to measure the water content of **soil** (by measuring the dielectric permittivity of the **soil**, which is a function of the water content). Simply insert this rugged **sensor** into the **soil** to be tested, and the volumetric water content of the **soil** is reported in percent.



a. How does a soil moisture sensor work?

A small charge is placed on the electrodes and electrical resistance through the **sensor** is measured. As water is used by plants or as the **soil moisture** decreases, water is drawn from the **sensor** and resistance increases. Conversely, as **soil moisture** increases, resistance decreases.

b. What is the output of soil moisture sensor?

The **output** of the **soil moisture sensor** changes in the range of ADC value from 0 to 1023. This can be represented as **moisture** value in terms of percentage using formula given below. For zero **moisture**, we get maximum value of 10-bit ADC, i.e. 1023. This, in turn, gives 0% **moisture**

Fire Sensor-

A **sensor** which is most sensitive to a normal light is known as a **flame sensor**. That's why this **sensor** module is used in **flame** alarms. This **sensor** detects **flame** otherwise wavelength within the range of 760 nm – 1100 nm from the light source. ... The output of this **sensor** is an analog signal or digital signal.

a. How does a fire sensor work?

A **fire detector works** by detecting **smoke** and/or heat. These devices respond to the presence of **smoke** or extremely high temperatures that are present with a **fire**. However, other **sensors** are multi-function, and they will detect the presence of both **smoke** and high temperatures. ...

b. What are the specifications of a flame sensor?

The IR **flame sensor** is used to detect the presence of fire or other infrared source (**Flame** or a light source of a wavelength in the range of 760 nm to 1100 nm can be detected).

Ultrasonic Sensor-

An **ultrasonic sensor** is an electronic device that measures the distance of a target object by emitting **ultrasonic** sound waves, and converts the reflected sound into an electrical signal. **Ultrasonic** waves travel faster than the speed of audible sound (i.e. the sound that humans can hear).

a. How does the ultrasonic sensor work?

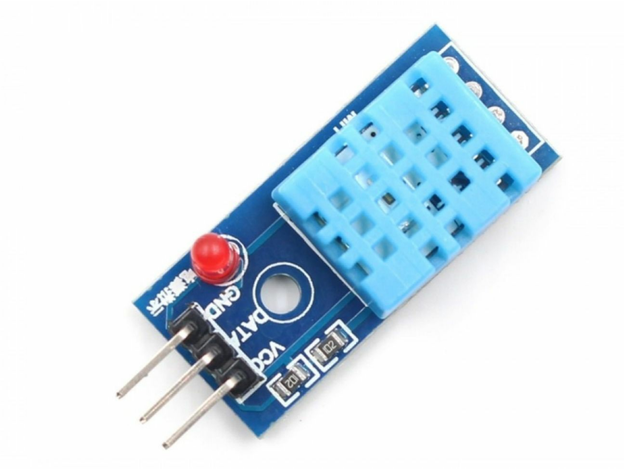
An **ultrasonic sensor** is an electronic device that measures the distance of a target object by emitting **ultrasonic** sound waves, and converts the reflected sound into an electrical signal. **Ultrasonic** waves travel faster than the speed of audible sound (i.e. the sound that humans can hear).

b. What is the output of ultrasonic sensor?

The **sensor** is small, easy to use in any robotics project and offers excellent non-contact range detection between 2 cm to 400 cm (that's about an inch to 13 feet) with an accuracy of 3mm. Since it operates on 5 volts, it can be hooked directly to an Arduino or any other 5V logic microcontrollers.

DHT11 Sensor-

The **DHT11** is a basic, ultra low-cost digital temperature and humidity **sensor**. It uses a capacitive humidity **sensor** and a thermistor to measure the surrounding air, and spits out a digital signal on the data pin (no analog input pins needed). Its fairly simple to use, but requires careful timing to grab data.



a. How does a DHT11 sensor work?

The **DHT11** calculates relative humidity by measuring the electrical resistance between two electrodes. The humidity **sensing** component of the **DHT11** is a moisture holding substrate with the electrodes applied to the surface.

b. What is the output of DHT11 sensor?

DHT11 Specifications:

Operating Voltage: 3.5V to 5.5V. Operating current: 0.3mA (measuring) 60uA (standby) **Output**: Serial data. Temperature Range: 0°C to 50°C.

MQ135 Sensor-

Air quality **sensor** for detecting a wide range of **gases**, including NH3, NOx, alcohol, benzene, smoke and CO2. Ideal for use in office or factory. **MQ135 gas sensor** has high sensitivity to Ammonia, Sulfide and Benze steam, also sensitive to smoke and other harmful **gases**.

a. How does MQ135 sensor work?

An alcohol **sensor** detects the attentiveness of alcohol gas in the air and an analog voltage is an output reading. The **sensor** can activate at temperatures ranging from -10 to 50° C with a power supply is less than 150 Ma to 5V. The **sensing** range is from 0.04 mg/L to 4 mg/L, which is suitable for breathalyzers.

b. How do you calibrate a MQ 135 sensor?

While using the library-supported Arduino setup, **MQ-135** gas **sensor calibration** is done at first by finding the value of Ro in fresh air, and then using that value to find Rs through the formula: Rs = (Vcc/VRL-1)x RL, that means Rs = (5V/(sensorValue * (5.0/1023.0))-1)*RL.

MQ3 Sensor-

It is a low cost semiconductor **sensor** which can detect the presence of alcohol gases at concentrations from 0.05 mg/L to 10 mg/L. The sensitive material used for this **sensor** is SnO2, whose conductivity is lower in clean air. It's conductivity increases as the concentration of alcohol gases increases.

a. How does MQ3 sensor works?

MQ-3 gas **sensor** has high sensitity to Alcohol, and has good resistance to disturb of gasoline, smoke and vapor. This **sensor** provides an analog resistive output based on alcohol concentration. When the alcohol gas exist, the **sensor's** conductivity gets higher along with the gas concentration rising.

b. How do you calibrate a MQ-3 sensor?

Sensor Calibration Challenges

The poorly written **MQ-3** datasheet says to **calibrate** the **sensor** by exposing it to a known alcohol gas of 0.4mg/L. From there, you can determine gas alcohol content in terms of mg/L.

MQ9 Sensor-

Sensitive material of the **MQ9** gas **sensor** is SnO2, which with lower conductivity in clean air. It makes detection by the method of cycle high and low temperature, and detect CO when the low temperature (heated by 1.5V). ... When a high temperature (heated by 5.0V), it detects Methane, Propane, etc.

a. How does MQ-9 sensor work?

Sensitive material of **MQ-9** gas **sensor** is SnO2, which with lower conductivity in clean air. It make detection by method of cycle high and low temperature, and detect CO when low temperature (heated by 1.5V). ... When high temperature (heated by 5.0V), it cleans the other gases adsorbed under low temperature.

b. How do you calibrate a MQ9 sensor?

Calibration. You would need to **calibrate** the **MQ-**9 gas **sensor** and generate an equation that converts the analog values to PPM. To **calibrate**, you need to use a sample of known concentration in ppm or a CO gas meter.

MQ4 Sensor-

MQ4 Methane Gas **Sensor** detects the concentration of methane gas in the air and ouputs its reading as an analog voltage. The concentration **sensing** range of 300 ppm to 10,000 ppm is suitable for leak detection. ... The **sensor** can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5 V.

a. What is MQ4 gas sensor?

MQ4 Methane **Gas Sensor** detects the concentration of methane **gas** in the air and ouputs its reading as an analog voltage. The concentration sensing range of 300 ppm to 10,000 ppm is suitable for leak **detection**. ... The **sensor** can operate at temperatures from -10 to 50°C and consumes less than 150 mA at 5V

b. How do you calibrate a MQ4 sensor?

Calibration. You would need to **calibrate** the **MQ**-4 gas **sensor** and generate an equation that converts the analog values to PPM. To **calibrate**, you need to use a sample of known concentration in ppm or a CO gas meter.

Sound Sensor-

A **Sound Sensor** is a simple device that detects **sound**. It is simply put a Microphone with some processing circuit. Using a **Sound Sensor**, you can measure the intensity of **sound** from different sources like knocks, claps, loud voices, etc. The **Sound Sensor** used in this project is shown in the image below.

a. How does a sound sensor work?

Sound sensors work by detecting differences in air pressure and transforming them into electrical signals. ... **Sound** waves cause the diaphragm to vibrate, which vibrates the magnets and induces a current in the coil. The most common microphones used for music are dynamic, ribbon or condenser microphones.

b. How do you calibrate a sound sensor?

Now to calibrate the sensor, start clapping near the microphone and adjust the potentiometer until you see the Status LED on the module blink in response to your claps. That's it your sensor is now calibrated and ready for use.

Thermal Sensor-

The TMP36 **temperature sensor** is an easy way to measure **temperature** using an **Arduino**! The **sensor** can measure a fairly wide range of **temperature** (-50°C to

125°C), is fairly precise (0.1°C resolution), and is very low cost, making it a popular choice.

a. What is thermal sensor?

Temperature **sensors** are constructional elements for measuring temperature and employ the functional dependence of a certain physical property of the **sensor** material on temperature.

b. What is the use of thermal sensor?

Non-contact **temperature sensors** are usually infrared (IR) **sensors**. They remotely detect the IR energy emitted by an object and send a signal to a calibrated electronic circuit that determines the object's **temperature**. Among the contact **temperature sensors** are thermocouples and thermistors.

Photosensitive Sensor-

LDR **sensor** module is used to detect the intensity of light. It is associated with both analog output pin and digital output pin labelled as

AO and DO respectively on the board. ... The **sensor** has a potentiometer knob that can be adjusted to change the sensitivity of LDR towards light.

a. What is a photosensitive sensor?

Light **Sensors**. Light **Sensors** are **photoelectric** devices that convert light energy (photons) whether visible or infra-red light into an electrical (electrons) signal.

b. How do LDR sensors work?

The **working** principle of an **LDR** is photoconductivity, which is nothing but an optical phenomenon. When the light is absorbed by the material then the conductivity of the material enhances. When the light falls on the **LDR**, then the electrons in the valence band of the material are eager to the conduction band.

c. What are the types of LDR?

Light dependent resistors, LDRs or photoresistors fall into one of two types or categories: Intrinsic photoresistors: Intrinsic photoresistors use un-doped **semiconductor** materials including silicon or germanium.

Vibration Sensor-

When no **vibration** is detected, **Vibration sensor** output is 0 (low voltage),otherwise its output is 1(high voltage)。If **Arduino** get 0 (no **vibration**) from **vibration sensor** it will turn on green LED and turn off Red LED. If **Arduino** get 1 from **vibration sensor**, it will turn on Red LED and turn off green LED.

a. What is vibration sensor?

The **vibration sensor** is also called a piezoelectric **sensor**. These **sensors** are flexible devices which are used for measuring various processes. This **sensor** uses the piezoelectric effects while measuring the changes within acceleration, pressure, temperature, force otherwise strain by changing to an electrical charge.

b. What are the three types of vibration?

Machinery Vibrations can again be categorised into three types, depending on the nature of the vibrations:

- Torsional **Vibration**.
- Axial or Longitudinal **Vibration**.
- Lateral **Vibration**.

Rain Sensor-

The **rain sensor** detects water that comes short circuiting the tape of the printed circuits. The **sensor** acts as a variable resistance that will change status : the resistance increases when the **sensor** is wet and the resistance is lower when the **sensor** is dry.

a. How do rain sensors work?

The **rain sensor works** on the principle of total internal reflection. ... An infrared light beams at a 45-degree angle on a clear area of the windshield from the **sensor** inside the car. When it rains, the wet glass causes the light to scatter and lesser amount of light gets reflected back to the **sensor**.

b. What is raindrop sensor?

Raindrop Sensor is a tool used for sensing rain. It consists of two modules, a rain board that detects the rain and a control module, which compares the analog value, and converts it to a digital value

c. What is the use of rain detector?

Rain water detector will detect the rain and make an alert; rain water detector is used in the **irrigation** field, home automation, communication, automobiles etc. Here is the simple and reliable circuit of rain water detector which can be constructed at low cost

TILT Sensor-

A **Tilt Sensor** switch is an electronic device that detects the orientation of an object and gives its output High or Low accordingly. Basically, it has a mercury ball inside it which moves and makes the circuit. So **tilt sensor** can turn on or off the circuit based on the orientation.

a. How does a tilt sensor work?

Tilt sensor produces an electrical signal wh multiple axes (Uniaxial & Biaxial). **Tilt ser** original reference. This **sensor** provides val and horizontal **inclination tilt**.

b. How do you test a tilt sensor?

Testing your **sensor** is simple. Put your r touch the probes to the two leads. Then **tilt** t opens and closes. When pointing down, the s

Voltage Sensor-

The **Voltage Sensor** is a simple mod any other microcontroller with inp external **voltages** that are greater thar 5V in case of **Arduino**. Followir **Sensor** Module used in this project.