HAMATEUR CHATTER

The Milwaukee Radio Amateurs Club

November 2012 Volume 20, Issue

One of the World's Oldest Continuously Active Radio Amateur Clubs—since 1917

Skywarn Recognition Day begins at 6PM November 30th and ends at 6PM December 1st. Skywarn Recognition Day was developed in 1999 by the National Weather Service/NWS and the American Radio Relay League. It celebrates the contributions that volunteer Amateur (Ham) Radio Operators make to the NWS during times of severe weather.
During the recognition day period amateur radio operators are encouraged to make radio contact with participating NWS offices on frequencies listed in the below link. Ham radio operators at the Milwaukee/Sullivan NWS office will make announcements on local area repeaters. Each NWS office serving Wisconsin will participate.
http://www.wrh.noaa.gov/mtr/hamradio/

Skip Voros - WD9HAS
Executive Director
Milwaukee Area Skywarn Assoc.

FCC Seeks to Assign Entire Amateur Portion of 160 Meter Band to Primary Status to Amateur Radio Service, Proposes New LF Amateur Band at 135.7 -137.8 kHz.

On Tuesday, November 20, the FCC released a *Notice of Proposed Rulemaking* (ET Docket No. 12-338) that proposes to amend Parts 1, 2, 74, 78, 87, 90 and 97 of the Commission's rules. Part 97 governs the Amateur Radio Service. Conference (WRC-07) that concern those portions of the radio frequency spectrum between 108 MHz and 20.2 GHz and make certain updates to the rules in this frequency range. Most of the *NPRM* does not concern the Amateur Radio Service, but the FCC is requesting comments on the three parts that do: changing the allocation to the amateur portion of the 160 meter band, allocating a new Amateur Service band at 135.7-137.8 kHz and cleaning up the rules for the 10.0-10.5 GHz band.

Directors' Meeting Minutes

Board of directors meeting called to order at 7:04 pm by Dave Shank, KA9WXN incoming club president.

Director's present: Mark, AB9CD, Michael KC9CMT, Dave KA9WXN, Hal, KB9OZN, Joe, N9UX, Dan. N9ASA.

Absent: Al, KC9IJJ.

Preliminary discussions:
The meeting minutes from the September BOD meeting were accepted as published in the October HamChatter by a unanimous voice vote 5-0. The club Treasury holds a significant amount for this time of year, $18,000+/- in the club accounts. The club Cd's have been purchased and at static for the next year. A remittance still needs to be sent to the Pioneer Village and ARRL Spectrum Defense Fund. The Treasurers report was accepted as submitted by Joe N9UX, by a voice vote of 5-0.

Membership meetings: Presentations; October- Dave MRAC repeater, November K9VS about telescopes, with demonstration hardware, January, W9XT about the Arduino, He will be building a prototype board during his demonstration.

MRAC Officers:

Terms Expiring in 2014

- President – Dave, KA9WXN
- V-President– Dan, N9ASA
- Secretary – Mike, KC9CMT
- Treasurer – Joe, N9UX
- Director – Mark, AB9CD

Terms Expiring in 2013

- Director – Al, KC9IJJ
- Director – Hal , KB9OZN

The Club Phone Number is: (414) 332-MRAC or

(414) 332- 6 7 2 2

Visit our website at:

www.w9rh.org

Mail correspondence to:

M. R. A. C.

P.O. Box 240545

Milwaukee, WI 53223

Board of Directors' Meeting Minutes

The February presentation slot will be the annual food event after Joe N9UX talks about the February FM contest.

Nothing yet for March. March 29th will be the AES SuperFest in 2013. April is the election with May being the annual auction. Future meetings were suggested such as digital HF modes. The digital HF presentation should be a live presentation, with the presenter making contacts during the instructional period. A class on APRS could be put together easily enough.

The club needs to ask for volunteers and organize an election committee for the 2013 election. Dave, KA9WXN will be asking for volunteers during the October meeting.

DSL & the Phone, The monthly total for phone service will come out to $80.50/mo. The term of service for our phone service is one year, with the club having the option to renew at the same rates for two additional years (a total of 3 years). The service provider is AT&T. The change to the new service contract was approved by the Board of Director's by a voice vote of 5-0. Comments have be raised about dropping AT&T DSL and going to a separate carrier for this service, such as TimeWarner Cable business class. A plan for new service needs to be in place by June 1st, 2013 to facilitate an orderly transition for the incoming director's.

A new Post Office Box has been proposed to benefit the new treasure. More discussions on this topic in the future. A club Google mail account has been discussed for the club to use. Mark, AB9CD will look into this.

Hamfest: Does the club need to advertise more than we did last year. Joe suggested per-recorded messages for our repeater. The club webpage will include a link to the swapfest flier posted to the Yahoo club group. Information will be sent to the MRC91 information net for announcement. Pancho will receive information for club announcements. The clubs will be put altogether this year along the same line of tables. The idea came up of offering a sixth table free for any vendor that orders five tables in a row. There will be door prizes again this year.

Special Projects Committee: Dave, WB9BWP has acquired a copy of MS 2010 office and wants to build presentations using this format. The Board of Director's has no objection to this. The idea was discussed again as to what to do with club owned radios. Do we need to have these in storage? Or could we sell these and acquire some other type of equipment. Any equipment should be offered to club members first, then perhaps an on-line sale. We are in agreement as to selling this equipment.

Education: Some classes have been given on the 5.13 machine during the last month. Details to follow after next months meeting. MRC91 will be offering classes by Pat Morreti on Saturdays at AES. Patrick is a former president of the MRAC. Some Q&A is being done during the 145.13 trivia net on Tuesday nights. Two people teaching a class is ideal. AES has a room available if our club wants to start giving classes. Greenfield High School is another location of interest.

Repeater Report: The repeater is operation within normal parameters. The rain report is still a possibility for our club repeater. Mark, AB9CD will be working on this project during the future.

New Business:

It has been projected that everyone should be sitting down and attentive during any presentations given during club membership meetings. During presentations it is common respect to pay attention to the presenters.

The Travis Baird award: It has been discussed that this award should be reinstated for individuals that merit special consideration. There is a formal procedure that must be submitted to the award committee to give this award. ARRL should be notified of the presentation of the award, far enough in advance to allow publication to coincide with the award. An award of this magnitude should be a plaque or framed award. The Board of Director's will finalize what type of presentation to give in the future.

New Member Committee: The club wants to get something like this started to welcome new members that may come to a meeting to audit our club organization. Jerry, K9FI would be a natural for this.

A motion was made to adjourn the meeting at 8:48 pm by Mark, AB9CD, seconded by Michael KC9CMT. Meeting adjourned at 8:50 pm. The room was returned to an organized condition as it was when the room was opened.

Membership Meeting Minutes

The MRAC membership meeting was called to order at 7:08 pm by Dave, KA9WXM, club president. The Mic was passed around for introductions. A sign-in sheet was circulated for the recording of membership information and the recording of attendance.

Tonight's Program:

Tonight's program will be given by Dave, KA9WXN on the MRAC repeater hardware and facility. The club frequency is 145.390 MHz, -600 Hz, 127.3 Hz PL. Located on the old ("analog") TV tower for channel 10, 36, 18 Located north of Capitol Drive on Humboldt along the Milwaukee River. Down the block from the WTMJ Offices. The club site in includes Navy Mars VHF repeater. Multiple remote VHF receivers for MAARS, MSOE RC and MATC RC systems.
UHF- FM-38 443.800 MHz and W.I.N. 443.275 systems. Single receiver, transmitter output of 15 watts.

The repeater coverage from Sheboygan south to the Illinois border, west through Walworth County. The repeater was founded in 1992 by Ed Willie when he found a used repeater in Germantown, that came with the frequency 147.045 MHz. In 2000 the repeater was moved to the Eaton Corp. on 35th and Capital. In 2002, Dave Karr, KA9FUR found a used GE Master II for the club and we installed a new commercial antenna. This is when the frequency was changed to 145.390 MHz. Also in 2002, the club relocated to the present MATC

Membership Meeting Minutes

site. The site was the Sinclair Broadcast Tower. This tower had two unused runs of 2 ¼ inch hardline. This line was used by MPTV and Zenith to develop what is now our Digital TV standard. These tests were conducted in 1991. It was decided to make this tower a community site for multiple groups to use.

A pictorial presentation was given on the equipment within the repeater room at the facility. Our system is a voter controlled system, the picks up the strongest signal from the various sites and repeats it. All the power backup batteries have their own circuit breakers. In addition, each repeater shelf has its own circuit breaker.

The newest edition to the repeater facility is the data rack that contains modems & routers, with battery backup. A break was called for at 7:50 pm. The builder of our controller used to be a club member. Dave Karr designed the repeater speech board. That allows us to synthesize speech.

Dave called the business meeting to order at 8:25 pm.

The membership meeting minutes were accepted as published in the October HamChatter by a motion initiated by Dave, KA9WXN, motion made by Al, KC9IJJ, and seconded by Joe, N9UX, accepted by the membership by a unanimous voice vote. Joe, N9UX gave the treasurers report, the treasury is in good shape with all accounts in the black, additionally some funds in two CD's gaining interest. Al, KC9IJJ ,made the motion to accept the treasurers report as read, with Mark, AB9CD seconding the motion.

Next months presentation will be on amateur astronomy with a presenter being in his telescope and mount and discussing his hobby. Januaries meeting will be about the Arduino prototyping board family. Arduino is simple to get started with so this should be a good presentation. Suggestions for future meetings: HF Packet radio, SMD soldering using a reworking station, and how to use a oscilloscope. February we would like to have another food get together depending on the success of the prior weeks club hamfest.

A suggestion was made to have another 95th year special event station at AES some weekend in the very near future. Mark, AB9CD and Dave, KA9WXN will work on this. The new fliers have been printed up by Dan, N9ASA and should be placed at any and all events to publicize the clubs hamfest. The raffle will go on as scheduled at the November meeting. It was mentioned by the club president that the club's HamChatter is a very well done publication.

There will be a food gathering at Denny's with Pancho after the club meeting.

Dave accepted motions to adjourn the meeting at 8:45 pm. Motion made by Joe, N9UX seconded by Pancho, N9OFA. Meeting adjourned at 9:50 pm. The room was then policed of trash and returned to an acceptable condition as found before the meeting commenced. A parts raffle will commence after a short break.

Newsline

Dispelling Fact from Fiction

Uranium Shock Horror Threat

On 29 November 2007 the BBC reported that three conspirators were arrested in Slovakia for acquiring 500g of "highly enriched uranium" powder. It was said to be "enriched enough" to make a dirty bomb. This is yet another demonstration of the almost total popular ignorance of many scientific facts. The uranium was probably pure uranium enriched in the 235 isotope. They do not say how enriched, but 500g of even pure U235 would not be enough to make a bomb. That the sample was radioactive would have been difficult to determine (it was shown being held in the hand).

If it were stored for a few million years, its activity might approach that of natural uranium, which is very feeble. If terrorists wanted to blow it up in a dirty bomb, they should be sure to tell someone, else their deed might go completely unnoticed. There would be no radioactivity, and the uranium would be quite insoluble, so would not leach into the water supply, where it wouldn't do much anyway. It is humorous that the world thinks that "enriching" uranium makes it more radioactive. Now if the terrorists could get enough together to go critical, they probably would not have time enough to do anything about it, and the radioactivity would make a rather small hot spot (there wouldn't be much, since the burn up would be very tiny, but enough to make them resemble boiled lobsters). Uranium is hardly radioactive at all, in fact. Enriched uranium is no more radioactive than depleted uranium. Uranium is quite dense (sp.gr. 19). A bare sphere of 8.3 cm radius of U235, weighing 44.8 kg, can go critical (see American Journal of Physics. **75**, 1065-1072 (2007)).

Severe Weather Preparedness

Winter Storms & Extreme Cold

Inspire others to act by being an example yourself, Pledge to Prepare & tell others about it!

PLEDGE TO PREPARE

While the danger from winter weather varies across the country, nearly all Americans, regardless of where they live, are likely to face some type of severe winter weather at some point in their lives. Winter storms can range from a moderate snow over a few hours to a blizzard with blinding, wind-driven snow that lasts for several days. Many winter storms are accompanied by dangerously low temperatures and sometimes by strong winds, icing, sleet and freezing rain. One of the primary concerns is the winter weather's ability to knock out heat, power and communications services to your home or office, sometimes for days at a time. Heavy snowfall and extreme cold can immobilize an entire region.

The National Weather Service refers to winter storms as the "Deceptive Killers" because most deaths are indirectly related to the storm. Instead, people die in traffic accidents on icy roads and of hypothermia from prolonged exposure to cold. It is important to be prepared for winter weather before it strikes.

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Before Winter Storms and Extreme Cold

To prepare for a winter storm you should do the following: Before winter approaches, add the following supplies to your emergency kit:

Rock salt or more environmentally safe products to melt ice on walkways. Visit the Environmental Protection Agency for a complete list of recommended products.

- Sand to improve traction.

Snow shovels and other snow removal equipment.

- Sufficient heating fuel. You may become isolated in your home and regular fuel sources may be cut off. Store a good supply of dry, seasoned wood for your fireplace or wood-burning stove.
- Adequate clothing and blankets to keep you warm.

Make a Family Communications Plan. Your family may not be together when disaster strikes, so it is important to know how you will contact one another, how you will get back together and what you will do in case of an emergency.

Listen to a NOAA Weather Radio or other local news channels for critical information from the National Weather Service (NWS). Be alert to changing weather conditions.

Minimize travel. If travel is necessary, keep a disaster supplies kit in your vehicle.

Bring pets/companion animals inside during winter weather. Move other animals or livestock to sheltered areas with non-frozen drinking water.

Winterize Your Vehicle

Check or have a mechanic check the following items on your car:

- **Antifreeze levels** - ensure they are sufficient to avoid freezing.
- **Battery and ignition system** - should be in top condition and battery terminals should be clean.
- **Brakes** - check for wear and fluid levels.
- **Exhaust system** - check for leaks and crimped pipes and repair or replace as necessary. Carbon monoxide is deadly and usually gives no warning.

Severe Weather Preparedness

- **Fuel and air filters** - replace and keep water out of the system by using additives and maintaining a full tank of gas. A full tank will keep the fuel line from freezing.
- **Heater and defroster** - ensure they work properly.
- **Lights and flashing hazard lights** - check for serviceability.
- **Oil** - check for level and weight. Heavier oils congeal more at low temperatures and do not lubricate as well.
- **Thermostat** - ensure it works properly.
- **Windshield wiper equipment** - repair any problems and maintain proper washer fluid level.

Install good winter tires - Make sure the tires have adequate tread. All-weather radials are usually adequate for most winter conditions. However, some jurisdictions require that to drive on their roads, vehicles must be equipped with chains or snow tires with studs.

Update the emergency kits in your vehicles with:

- a shovel
- windshield scraper and small broom
- flashlight
- battery powered radio
- extra batteries
- water
- snack food
  Matches
- extra hats, socks and mittens
- first aid kit with pocket knife
- necessary medications
- blanket(s)
- tow chain or rope
- road salt and sand
- booster cables
- emergency flares
  fluorescent distress flag

During Winter Storms and Extreme Cold

- Stay indoors during the storm.
- Walk carefully on snowy, icy, walkways.
- Avoid overexertion when shoveling snow. Overexertion can bring on a heart attack—a major cause of death in the winter. If you must shovel snow, stretch before going outside.
- Keep dry. Change wet clothing frequently to prevent a loss of body heat. Wet clothing loses all of its insulating value and transmits heat rapidly.
- Watch for signs of frostbite. These include loss of feeling and white or pale appearance in extremities such as fingers, toes, ear lobes, and the tip of the nose. If symptoms are detected, get medical help immediately.
- Watch for signs of hypothermia. These include uncontrollable shivering, memory loss, disorientation, incoherence, slurred speech, drowsiness, and apparent exhaustion. If symptoms of hypothermia are detected, get the victim to a warm location, remove wet clothing, warm the center of the body first and give warm, non-alcoholic beverages if the victim is conscious. Get medical help as soon as possible.
- Drive only if it is absolutely necessary. If you must drive: travel in the day; don't travel alone; keep others informed of your schedule; stay on main roads and avoid back road shortcuts.
- Let someone know your destination, your route, and when you expect to arrive. If your car gets stuck along the way, help can be sent along your predetermined route.
- If the pipes freeze, remove any insulation or layers of newspapers and wrap pipes in rags. Completely open all faucets and pour hot water over the pipes, starting where they were most exposed to the cold (or where the cold was most likely to penetrate).
- Maintain ventilation when using kerosene heaters to avoid build-up of toxic fumes. Refuel kerosene heaters outside and keep them at least three feet from flammable objects.
- Conserve fuel, if necessary, by keeping your residence cooler than normal. Temporarily close off heat to some rooms.

If you will be going away during cold weather, leave the heat on in your home, set to a temperature no lower than 55ºF.

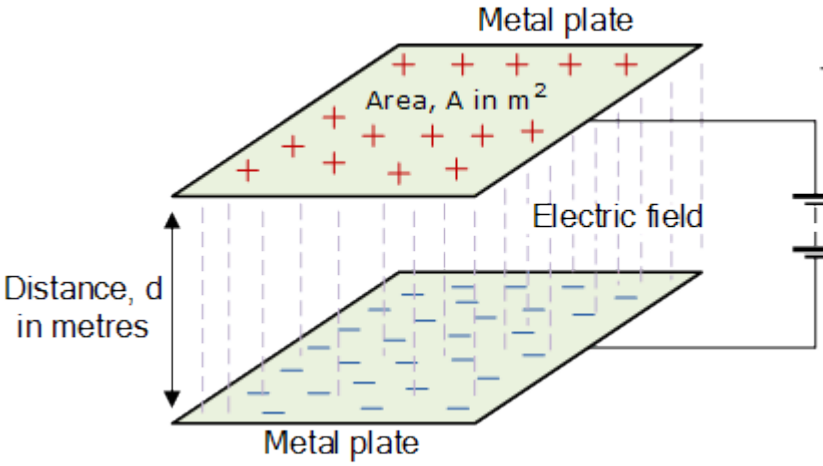
Dress for the Weather

- If you must go outside, wear several layers of loose-fitting, lightweight, warm clothing rather than one layer of heavy clothing. The outer garments should be tightly woven and water repellent.
- Wear mittens, which are warmer than gloves.
- Wear a hat. A hat will prevent loss of body heat.

Cover your mouth with a scarf to protect your lungs.

Introduction to Capacitors—Part II

Parallel Plate Capacitor



We have said previously that the capacitance of a parallel plate capacitor is proportional to the surface area A and inversely proportional to the distance, d between the two plates and this is true for dielectric medium of air. However, the capacitance value of a capacitor can be increased by inserting a solid medium in between the conductive plates which has a dielectric constant greater than that of air.
Typical values of epsilon ε for various commonly used dielectric materials are: Air = 1.0, Paper = 2.5 - 3.5, Glass = 3 - 10, Mica = 5 - 7 etc.

The factor by which the dielectric material, or insulator, increases the capacitance of the capacitor compared to air is known as the **Dielectric Constant**, (**k**). "k" is the ratio of the permittivity of the dielectric medium being used to the permittivity of free space otherwise known as a vacuum. Therefore, all the capacitance values are related to the permittivity of vacuum. A dielectric material with a high dielectric constant is a better insulator than a dielectric material with a lower dielectric constant. Dielectric constant is a dimensionless quantity since it is relative to free space.

$$C = \varepsilon\frac{A}{d}, \quad \varepsilon = 8.85\,pF/m$$

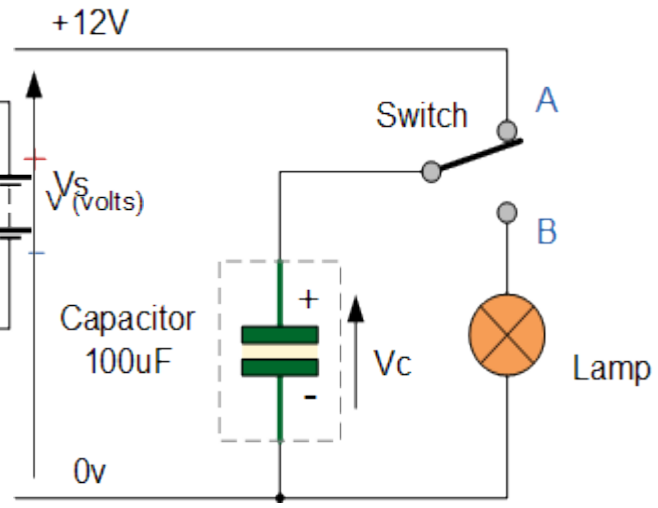
$$A = 100\,cm^2 = 0.01m^2, \quad d = 0.2\,cm = 0.002\,m$$

$$\therefore\ C = 8.85\times10^{-12}\times\frac{0.01\,m^2}{0.002\,m} = 44\,pF$$

Example No1
A parallel plate capacitor consists of two plates with a total surface area of 100 cm^2. What will be the capacitance in pico-Farads, (pF) of the capacitor if the plate separation is 0.2 cm, and the dielectric medium used is air. then the value of the capacitor is 44pF.

Charging & Discharging of a Capacitor

Consider the following circuit.



Assume that the capacitor is fully discharged and the switch connected to the capacitor has just been moved to position A. The voltage across the 100uf capacitor is zero at this point and a charging current (i) begins to flow charging up the capacitor until the voltage across the plates is equal to the 12v supply voltage. The charging current stops flowing and the capacitor is said to be "fully-charged ". Then, Vc = Vs = 12v.

Once the capacitor is "fully-charged" in theory it will maintain its state of voltage charge even when the supply voltage has been disconnected as they act as a sort of temporary storage device. However, while this may be true of an "ideal" capacitor, a real capacitor will slowly discharge itself over a long period of time due to the internal leakage currents flowing through the dielectric. This is an important point to remember as large value capacitors connected across high voltage supplies can still maintain a significant amount of charge even when the supply voltage is switched "OFF".

If the switch was disconnected at this point, the capacitor would maintain its charge indefinitely, but due to internal leakage currents flowing across its dielectric the capacitor would very slowly begin to discharge itself as the electrons passed through the dielectric. The time taken for the capacitor to discharge down to 37% of its supply voltage is known as its *Time Constant*.

If the switch is now moved from position A to position B, the fully charged capacitor would start to discharge through the lamp now connected across it, illuminating the lamp until the capacitor was fully discharged as the element of the lamp has a resistive value. The brightness of the lamp and the duration of illumination would ultimately depend upon the capacitance value of the capacitor and the resistance of the lamp (t = C x R). The larger the value of the capacitor the brighter and longer will be the illumination of the lamp as it could store more charge.

Example No2
Calculate the charge in the above capacitor circuit.

$$Q = C \times V$$

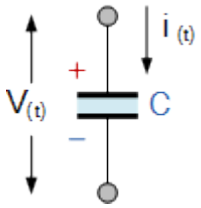
$$Q = 100\mu F \times 12v = 1.2 \times 10^{-3} = 1.2mC$$

then the charge on the capacitor is 1.2 millicoulombs.

Current through a Capacitor
The current that flows through a capacitor is directly related to the charge on the plates as current is the rate of flow of charge with respect to time. As the capacitors ability to store charge (Q) between its plates is proportional to the applied voltage (V), the relationship between the current and the voltage that is applied to the plates of a capacitor becomes:

Current-Voltage (I-V) Relationship

$$i_{(t)} = C\frac{dv}{dt}$$



As the voltage across the plates increases (or decreases) over time, the current flowing through the capacitance deposits (or removes) charge from its plates with the amount of charge being proportional to the applied voltage. Then both the current and voltage applied to a capacitance are functions of time and are denoted by the symbols, $i_{(t)}$ and $v_{(t)}$ However, from the above equation we can also see that if the voltage remains constant, the charge will become constant and therefore the current will be zero!. In other words, no change in voltage, no movement of charge and no flow of current. This is why a capacitor appears to "block" current flow when connected to a steady state DC voltage.

The Farad
We now know that the ability of a capacitor to store a charge gives it its capacitance value C, which has the unit of the **Farad, F**. But the farad is an extremely large unit on its own making it impractical to use, so submultiple's or fractions of the standard Farad unit are used instead. To get an idea of how big a Farad really is, the surface area of the plates required to produce a capacitor with a value of one Farad with a reasonable plate separation of just 1mm operating in a vacuum and rearranging the equation for capacitance above would be:

$$A = Cd \div 8.85pF/m = (1 \times 0.001) \div 8.85 \times 10^{-12} = 112{,}994{,}350\ m^2$$

or 113 million m^2 which would be equivalent to a plate of more than 10 kilometers x 10 kilometers square.
Capacitors which have a value of one Farad or more tend to have a solid dielectric and as "One Farad" is such a large unit to use, prefixes are used instead in electronic formulas with capacitor values given in micro-Farads (μF), nano-Farads (nF) and the pico-Farads (pF). For example:

Sub-units of the Farad

$$\text{microfarad, } (\mu F) = \frac{1}{1{,}000{,}000} F = 1 \times 10^{-6} F$$

$$\text{nanofarad, } (nF) = \frac{1}{1{,}000{,}000{,}000} F = 1 \times 10^{-9} F$$

$$\text{picofarad, } (pF) = \frac{1}{1{,}000{,}000{,}000{,}000} F = 1 \times 10^{-12} F$$

Convert the following capacitance values from a) **22nF** to **uF**, b) **0.2uF** to **nF**, c) **550pF** to **uF**.

a) 22nF = 0.022uF
b) 0.2uF = 200nF
c) 550pF = 0.00055uF

While one Farad is a large value on its own, capacitors are now commonly available with capacitance values of many hundreds of Farads and have names to reflect this of "Supercapacitors" or "Ultracapacitors". These capacitors are electrochemical energy storage devices which utilize a high surface area of their carbon dielectric to deliver much higher energy densities than conventional capacitors and as capacitance is proportional to the surface area of the carbon, the thicker the carbon the more capacitance it has.

Low voltage (from about 3.5V to 5.5V) supercapacitors are capable of storing large amounts of charge due to their high capacitance values as the energy stored in a capacitor is equal to $1/2(C \times V^2)$. Low voltage supercapacitors are commonly used in portable hand held devices to replace large, expensive and heavy lithium type batteries as they give battery-like storage and discharge characteristics making them ideal for use as an alternative power source or for memory backup. Supercapacitors used in hand held devices are usually charged using solar cells fitted to the device.

Ultracapacitor are being developed for use in hybrid electric cars and alternative energy applications to replace large conventional batteries as well as DC smoothing applications in vehicle audio and video systems. Ultracapacitors can be recharged quickly and have very high energy storage densities making them ideal for use in electric vehicle applications.

Energy in a Capacitor
When a capacitor charges up from the power supply connected to it, an electrostatic field is established which stores energy in the capacitor. The amount of energy in **Joules** that is stored in this electrostatic field is equal to the energy the voltage supply exerts to maintain the charge on the plates of

$$\text{Energy, } W = \frac{1}{2}CV^2 \text{ or } \frac{CV^2}{2} \text{ in Joules, (j)}$$

so the energy stored in the 100uF capacitor circuit above is calculated as:

$$\text{Energy, } W = \frac{CV^2}{2} = \frac{100\times10^{-6}\times12^2}{2} = 7.2\text{mJ}$$

The next tutorial in our section about Capacitors, we look at *Capacitor Colour Codes* and see the different ways that the capacitance and voltage values of the capacitor are marked onto its body.

Capacitor Colour Codes

Generally, the actual values of Capacitance, Voltage or Tolerance are marked onto the body of the capacitors in the form of alphanumeric characters. However, when the value of the capacitance is of a decimal value problems arise with the marking of a "Decimal Point" as it could easily not be noticed resulting in a misreading of the actual value. Instead letters such as p (pico) or n (nano) are used in place of the decimal point to identify its position and the weight of the number. For example, a capacitor can be labeled as, n47 = 0.47nF, 4n7 = 4.7nF or 47n = 47nF and so on. Also, sometimes capacitors are marked with the capital letter K to signify a value of one thousand pico-Farads, so for example, a capacitor with the markings of 100K would be 100 x 1000pF or 100nF.

To reduce the confusion regarding letters, numbers and decimal points, an International colour coding scheme was developed many years ago as a simple way of identifying capacitor values and tolerances. It consists of colored bands (in spectral order) known commonly as the **Capacitor Colour Code** system and whose meanings are illustrated below:

Capacitor Colour Code Table

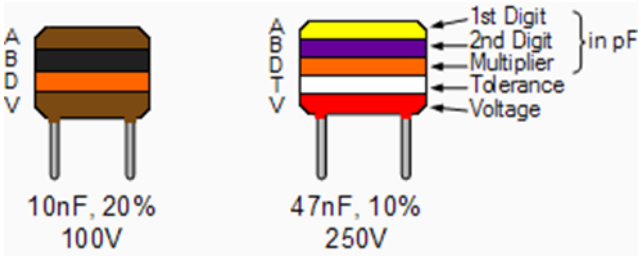
Colour	Digit A	Digit B	Multiplier D	Tolerance (T) > 10pf	Tolerance (T) < 10pf	Temperature Coefficient (TC)
Black	0	0	x1	± 20%	± 2.0pF	
Brown	1	1	x10	± 1%	± 0.1pF	-33×10^{-6}
Red	2	2	x100	± 2%	± 0.25pF	-75×10^{-6}
Orange	3	3	x1,000	± 3%		-150×10^{-6}
Yellow	4	4	x10,000	± 4%		-220×10^{-6}
Green	5	5	x100,000	± 5%	± 0.5pF	-330×10^{-6}
Blue	6	6	x1,000,000			-470×10^{-6}
Violet	7	7				-750×10^{-6}
Grey	8	8	x0.01	+80%,-20%		
White	9	9	x0.1	± 10%	± 1.0pF	
Gold			x0.1	± 5%		
Silver			x0.01	± 10%		

Capacitor Voltage Reference

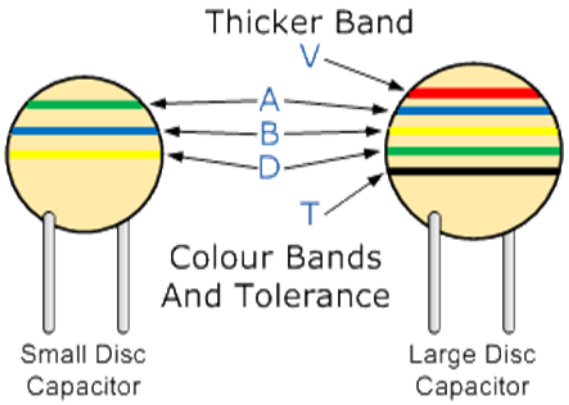
- Type J - Dipped Tantalum Capacitors.
- Type K - Mica Capacitors.
- Type L - Polyester/Polystyrene Capacitors.
- Type M - Electrolytic 4 Band Capacitors.
- Type N - Electrolytic 3 Band Capacitors.

An example of the use of capacitor colour codes is given as:

Metalized Polyester Capacitor



Disc & Ceramic Capacitor



The **Capacitor Colour Code** system was used for many years on unpolarised polyester and mica molded capacitors. This system of colour coding is now obsolete but there are still many "old" capacitors around. Nowadays, small capacitors such as film or disk types conform to the BS1852 Standard and its new replacement, BS EN 60062, were the colors have been replaced by a letter or number coded system.

Generally the code consists of 2 or 3 numbers and an optional tolerance letter code to identify the tolerance. Where a two number code is used the value of the capacitor only is given in picofarads, for example, 47 = 47 pF and 100 = 100pF etc. A three letter code consists of the two value digits and a multiplier much like the resistor colour codes in the resistors section.

The Experimenters Bench

Capacitor Voltage Colour Code Table

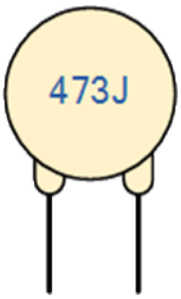
Colour	Voltage Rating (V)				
	Type J	Type K	Type L	Type M	Type N
Black	4	100		10	10
Brown	6	200	100	1.6	
Red	10	300	250	4	35
Orange	15	400		40	
Yellow	20	500	400	6.3	6
Green	25	600		16	15
Blue	35	700	630		20
Violet	50	800			
Grey		900		25	25
White	3	1000		2.5	3
Gold		2000			
Silver					

For example, the digits 471 = 47*10 = 470pF. Three digit codes are often accompanied by an additional tolerance letter code as given below.

Capacitor Tolerance Letter Codes Table

	Letter	B	C	D	F	G	J	K	M	Z
Tolerance	C <10pF ±pF	0.1	0.25	0.5	1	2				
	C >10pF ±%			0.5	1	2	5	10	20	+80-20

Consider the capacitor below:



The capacitor on the left is of a ceramic disc type capacitor that has the code 473J printed onto its body. Then the 4 = 1st digit, the 7 = 2nd digit, the 3 is the multiplier in pico-Farads, pF and the letter J is the tolerance and this translates to:

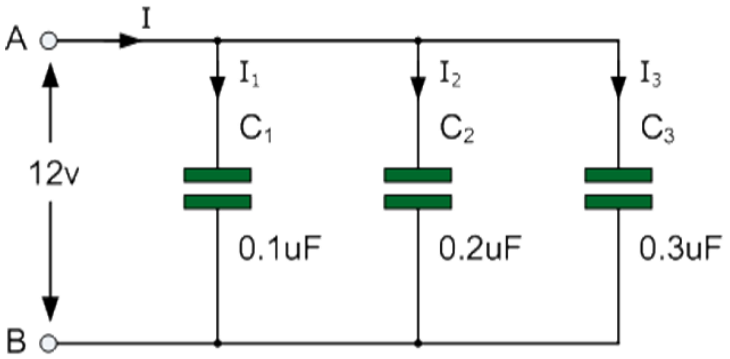
47pF * 1,000 (3 zero's) = 47,000 pF , 47nF or 0.047 uF the J indicates a tolerance of +/- 5%

Capacitors in Parallel

Capacitors are said to be connected together "in parallel" when both of their terminals are respectively connected to each terminal of the other capacitor or capacitors. The voltage (Vc) connected across all the capacitors that are connected in parallel is **THE SAME**. Then, **Capacitors in Parallel** have a "common voltage" supply across them giving

$V_{C1} = V_{C2} = V_{C3} = V_{AB} = 12V$

In the following circuit the capacitors, C_1, C_2 and C_3 are all connected together in a parallel branch between points A and B as shown.



When capacitors are connected together in parallel the total or equivalent capacitance, C_T in the circuit is equal to the sum of all the individual capacitors added together. The currents flowing through each capacitor and as we saw in the previous tutorial are related to the voltage. Then by applying *Kirchoff's Current Law*, (KCL) to the above circuit, we have

$$i_1 = C_1\frac{dv}{dt}, \quad i_2 = C_2\frac{dv}{dt}, \quad i_3 = C_3\frac{dv}{dt}$$

$$i_T = i_1 + i_2 + i_3$$

$$\therefore i_T = C_1\frac{dv}{dt} + C_2\frac{dv}{dt} + C_3\frac{dv}{dt}$$

and this can be re-written as:

$$i_T = \left(C_1 + C_2 + C_3\right)\frac{dv}{dt}$$

Then we can define the total or equivalent circuit capacitance, C_T as being the sum of all the individual capacitances add together giving us the generalized equation of

Parallel Capacitors Equation

$$C_T = C_1 + C_2 + C_3 + \ldots etc$$

When adding together capacitors in parallel, they must all be converted to the same capacitance units, whether it is uF, nF or pF. Also, we can see that the current flowing through the total capacitance value, C_T is the same as the total circuit current, i_T

We can also define the total capacitance of the parallel circuit from the total stored charge using the Q = CV equation for charge on a capacitors plates. The total charge Q_T stored on all the plates equals the sum of the individual stored charges on each capacitor therefore,

$$Q_T = Q_1 + Q_2 + Q_3 \qquad \text{but, } Q = CV$$

$$\therefore Q_T = CV_T = CV_1 + CV_2 + CV_3$$

$$\text{or} \quad C_T = C_1 + C_2 + C_3$$

Then by just using numbers and letters as codes on the body of the capacitor we can easily determine the value of its capacitance either in Pico-farad's, Nano-farads or Micro-farads and a list of these "international" codes is given in the following table along with their equivalent capacitances.

Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code	Picofarad (pF)	Nanofarad (nF)	Microfarad (uF)	Code
10	0.01	0.00001	100	4700	4.7	0.0047	472
15	0.015	0.000015	150	5000	5.0	0.005	502
22	0.022	0.000022	220	5600	5.6	0.0056	562
33	0.033	0.000033	330	6800	6.8	0.0068	682
47	0.047	0.000047	470	10000	10	0.01	103
100	0.1	0.0001	101	15000	15	0.015	153
120	0.12	0.00012	121	22000	22	0.022	223
130	0.13	0.00013	131	33000	33	0.033	333
150	0.15	0.00015	151	47000	47	0.047	473
180	0.18	0.00018	181	68000	68	0.068	683
220	0.22	0.00022	221	100000	100	0.1	104
330	0.33	0.00033	331	150000	150	0.15	154
470	0.47	0.00047	471	200000	200	0.2	254
560	0.56	0.00056	561	220000	220	0.22	224
680	0.68	0.00068	681	330000	330	0.33	334
750	0.75	0.00075	751	470000	470	0.47	474
820	0.82	0.00082	821	680000	680	0.68	684
1000	1.0	0.001	102	1000000	1000	1.0	105
1500	1.5	0.0015	152	1500000	1500	1.5	155
2000	2.0	0.002	202	2000000	2000	2.0	205
2200	2.2	0.0022	222	2200000	2200	2.2	225
3300	3.3	0.0033	332	3300000	3300	3.3	335

As the voltage,(V) is common for parallel connected capacitors, we can divide both sides of the above equation through by the voltage leaving just the capacitance and by simply adding together the value of the individual capacitances gives the total capacitance, C_T. Also, this equation is not dependent upon the number of **Capacitors in Parallel** in the branch, and can therefore be generalized for any number of parallel capacitors connected together.

Example No1

So by taking the values of the three capacitors from the above example, we can calculate the total equivalent circuit capacitance C_T as being:

$C_T = C_1 + C_2 + C_3 = 0.1uF + 0.2uF + 0.3uF = 0.6uF$

One important point to remember about parallel connected capacitor circuits, the total capacitance (C_T) of any two or more capacitors connected together in parallel will always be **GREATER** than the value of the largest capacitor in the group as we are adding together values.

So in our example above $C_T = 0.6uF$ whereas the largest value capacitor is only 0.3uF.

When 4, 5, 6 or even more capacitors are connected together the total capacitance of the circuit C_T would still be the sum of all the individual capacitors added together and as we know now, the total capacitance of a parallel circuit is always greater than the highest value capacitor. This is because we have effectively increased the total surface area of the plates. If we do this with two identical capacitors, we have doubled the surface area of the plates which in turn doubles the capacitance of the combination and so on.

Example No2.

Calculate the combined capacitance in micro-Farads (uF) of the following capacitors when they are connected together in a parallel combination:

- a) two capacitors each with a capacitance of 47nF
- b) one capacitor of 470nF connected in parallel to a capacitor of 1uF

a) Total Capacitance,

$$C_T = C_1 + C_2 = 47nF + 47nF = 94nF \text{ or } 0.094uF$$

b) Total Capacitance,

$$C_T = C_1 + C_2 = 470nF + 1uF$$

therefore, $C_T = 470nF + 1000nF = 1470nF$ or $1.47uF$

So, the total or equivalent capacitance, C_T of a circuit containing **Capacitors in Parallel** is the sum of the all the individual capacitances added together and in our next tutorial about Capacitors, we look at connecting together *Capacitors in Series* and the affect this combination has on the circuits total capacitance, voltage and current.

Capacitors in Series

Capacitors are said to be connected together "in series" when they are effectively "daisy chained" together in a single line. The charging current (i_C) flowing through the capacitors is **THE SAME** for all capacitors as it only has one path to follow and $i_T = i_1 = i_2 = i_3$ etc. Then, **Capacitors in Series** all have

Voltage drop across the capacitors,

$$V_{C1} = \frac{V_T}{C_1 + C_2} \times C_2 = \frac{12}{47nF + 47nF} \times 47nF = 6 \text{ volts}$$

$$V_{C2} = \frac{V_T}{C_1 + C_2} \times C_1 = \frac{12}{47nF + 47nF} \times 47nF = 6 \text{ volts}$$

b) Total Capacitance,

$$C_T = \frac{C_1 \times C_2}{C_1 + C_2} = \frac{470nF \times 1uF}{470nF + 1uF} = 320nF$$

Voltage drop across Capacitors,

$$V_{C1} = \frac{V_T}{C_1 + C_2} \times C_2 = \frac{12}{470nF + 1uF} \times 1uF = 8.16 \text{ volts}$$

$$V_{C2} = \frac{V_T}{C_1 + C_2} \times C_1 = \frac{12}{470nF + 1uF} \times 470nF = 3.84 \text{ volts}$$

So, the total or equivalent capacitance, C_T of a circuit containing **Capacitors in Series** is the reciprocal of the sum of the reciprocals of all of the individual capacitances added together.

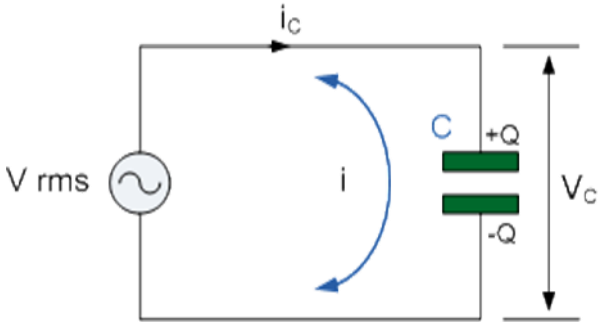
Capacitance in AC Circuits

When capacitors are connected across a direct current DC supply voltage they become charged to the value of the applied voltage, acting like temporary storage devices and maintain or hold this charge indefinitely as long as the supply voltage is present. During this charging process, a charging current, (i) will flow into the capacitor opposing any changes to the voltage at a rate that is equal to the rate of change of the electrical charge on the plates.

This charging current can be defined as: i = CdV/dt. Once the capacitor is "fully-charged" the capacitor blocks the flow of any more electrons onto its plates as they have become saturated. However, if we apply an alternating current or AC supply, the capacitor will alternately charge and discharge at a rate determined by the frequency of the supply. Then the **Capacitance in AC circuits** varies with frequency as the capacitor is being constantly charged and discharged.

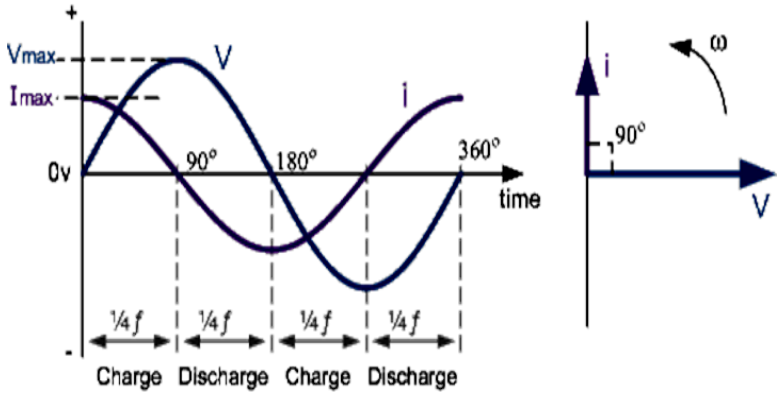
We know that the flow of electrons through the capacitor is directly proportional to the rate of change of the voltage across the plates. Then, we can see that capacitors in AC circuits like to pass current when the voltage across its plates is constantly changing with respect to time such as in AC signals, but it does not like to pass current when the applied voltage is of a constant value such as in DC signals. Consider the circuit below.

AC Capacitor Circuit



In the purely capacitive circuit above, the capacitor is connected directly across the AC supply voltage. As the supply voltage increases and decreases, the capacitor charges and discharges with respect to this change. We know that the charging current is directly proportional to the rate of change of the voltage across the plates with this rate of change at its greatest as the supply voltage crosses over from its positive half cycle to its negative half cycle or vice versa at points, 0° and 180° along the sine wave. Consequently, the least voltage change occurs when the AC sine wave crosses over at its maximum or minimum peak voltage level, (Vm). At these positions in the cycle the maximum or minimum currents are flowing through the capacitor circuit and this is shown below.

AC Capacitor Phasor Diagram



At 0° the rate of change of the supply voltage is increasing in a positive direction resulting in a maximum charging current at that instant in time. As the applied voltage reaches its maximum peak value at 90° for a very brief instant in time the supply voltage is neither increasing or decreasing so there is no current flowing through the circuit. As the applied voltage begins to decrease to zero at 180°, the slope of the voltage is negative so the capacitor discharges in the negative direction. At the 180° point along the line the rate of change of the voltage is at its maximum again so maximum current flows at that instant and so on.

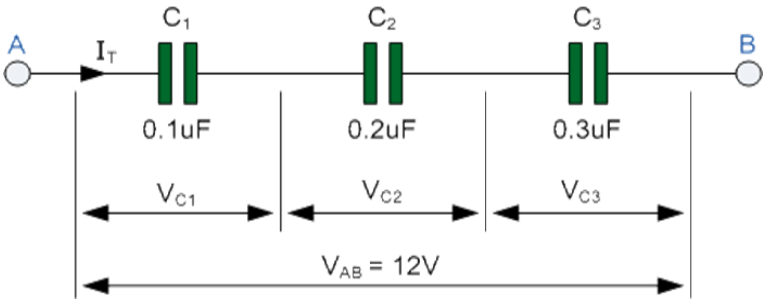
Then we can say that for capacitors in AC circuits the instantaneous current is at its minimum or zero whenever the applied voltage is at its maximum and likewise the instantaneous value of the current is at its maximum or peak value when the applied voltage is at its minimum or zero. From the waveform above, we can see that the current is leading the voltage by 1/4 cycle or 90° as shown by the vector diagram.

the same current so each capacitor stores the same amount of charge regardless of its capacitance. This is because the charge stored by a plate of any one capacitor must have come from the plate of its adjacent capacitor therefore,

$$Q_T = Q_1 = Q_2 = Q_3 \text{ ....etc}$$

In the following circuit, capacitors, C_1, C_2 and C_3 are all connected together in a series branch between points A and B.

Capacitors in a Series Connection



In the previous parallel circuit we saw that the total capacitance, C_T of the circuit was equal to the sum of all the individual capacitors added together. In a series connected circuit however, the total or equivalent capacitance C_T is calculated differently. The voltage drop across each capacitor will be different depending upon the values of the individual capacitances. Then by applying *Kirchhoff's Voltage Law*, (KVL) to the above circuit, we get:

$$V_{AB} = V_{C1} + V_{C2} + V_{C3} = 12V$$

$$V_{C1} = \frac{Q_T}{C_1}, \quad V_{C2} = \frac{Q_T}{C_2}, \quad V_{C3} = \frac{Q_T}{C_3}$$

Since Q = CV or V = Q/C, substituting Q/C for each capacitor voltage V_C in the above KVL equation gives us

$$V_{AB} = \frac{Q_T}{C_T} = \frac{Q_T}{C_1} + \frac{Q_T}{C_2} + \frac{Q_T}{C_3}$$

dividing each term through by Q gives

Series Capacitors Equation

$$\frac{1}{C_T} = \frac{1}{C_1} + \frac{1}{C_2} + \frac{1}{C_3} + \ldots\text{etc}$$

When adding together **Capacitors in Series**, the reciprocal (1/C) of the individual capacitors are all added together (just like resistors in parallel) instead of the capacitances themselves. Then the total value for capacitors in series equals the reciprocal of the sum of the reciprocals of the individual capacitances.

Example No1

Taking the three capacitor values from the above example, we can calculate the total circuit capacitance for the three capacitors in series as:

$$\frac{1}{C_T} = \frac{1}{0.1\mu F} + \frac{1}{0.2\mu F} + \frac{1}{0.3\mu F} = \frac{1}{18.33 \times 10^{6}}$$

$$\therefore C = 0.055\mu F \text{ or } 55nF$$

One important point to remember about capacitors that are connected together in a series configuration, is that the total circuit capacitance (C_T) of any number of capacitors connected together in series will always be **LESS** than the value of the smallest capacitor in the series and in our example above C = 0.055uF where as the value of the smallest capacitor in the series chain is only 0.1uF.

This reciprocal method of calculation can be used for calculating any number of capacitors connected together in a single series network. If however, there are only two capacitors in series, then a much simpler and quicker formula can be used and is given as:

$$C_T = \frac{C_1 \times C_2}{C_1 + C_2}$$

Example No2

Find the overall capacitance and the individual voltage drops across the following sets of two capacitors in series when connected to a 12V d.c. supply.

- a) two capacitors each with a capacitance of 47nF
- b) one capacitor of 470nF connected in series to a capacitor of 1uF

a) Total Capacitance,

$$C_T = \frac{C_1 \times C_2}{C_1 + C_2} = \frac{47nF \times 47nF}{47nF + 47nF} = 23.5nF$$

Then we can say that in a purely capacitive circuit the alternating voltage **lags** the current by 90°.
We know that the current flowing through the capacitance in AC circuits is in opposition to the rate of change of the applied voltage but just like resistors, capacitors also offer some form of resistance against the flow of current through the circuit, but with capacitors in AC circuits this AC resistance is known as **Reactance** or more commonly in capacitor circuits, **Capacitive Reactance**, so capacitance in AC circuits suffers from **Capacitive Reactance**.

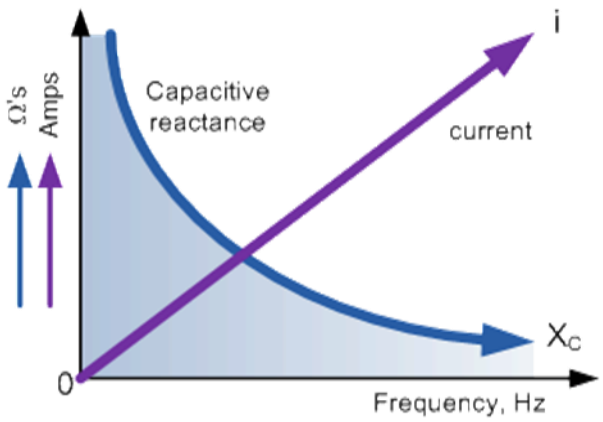
Capacitive Reactance
Capacitive Reactance in a purely capacitive circuit is the opposition to current flow in AC circuits only. Like resistance, reactance is also measured in Ohm's but is given the symbol X to distinguish it from a purely resistive value. As reactance can also be applied to Inductors as well as Capacitors it is more commonly known as **Capacitive Reactance** for capacitors in AC circuits and is given the symbol Xc so we can actually say that **Capacitive Reactance** is **Resistance** that varies with frequency. Also, capacitive reactance depends on the value of the capacitor in Farads as well as the frequency of the AC waveform and the formula used to define capacitive reactance is given as:

Capacitive Reactance

$$X_C = \frac{1}{2\pi f C} = \frac{1}{\omega C}$$

Where:
F is in Hertz and C is in Farads.
2πF can also be expressed collectively as the Greek letter **Omega**, ω to denote an angular frequency.
From the capacitive reactance formula above, it can be seen that if either of the **Frequency** or **Capacitance** where to be increased the overall capacitive reactance would decrease. As the frequency approaches infinity the capacitors reactance would reduce to zero acting like a perfect conductor. However, as the frequency approaches zero or DC, the capacitors reactance would increase up to infinity, acting like a very large resistance. This means then that capacitive reactance is "**Inversely proportional**" to frequency for any given value of Capacitance and this shown below:

Capacitive Reactance against Frequency



The capacitive reactance of the capacitor decreases as the frequency across it increases therefore capacitive reactance is inversely proportional to frequency.

The opposition to current flow, the electrostatic charge on the plates (its AC capacitance value) remains constant as it becomes easier for the capacitor to fully absorb the change in charge on its plates during each half cycle.

Also as the frequency increases the current flowing through the capacitor increases in value because the rate of voltage change across its plates increases.

Example No1.
Find the current flowing in a circuit when a 4uF capacitor is connected across a 880v, 60Hz supply.

$$X_C = \frac{1}{2\pi fC} = \frac{1}{2\pi \times 60 \times (4 \times 10^{-6})} = 663\Omega$$

$$I = \frac{V}{X_C} = \frac{880}{663} = 1.33\text{Amps}$$

So, the **Capacitance in AC circuits** varies with frequency as the capacitor is being constantly charged and discharged with the AC resistance of a capacitor being known as **Reactance** or more commonly in capacitor circuits, **Capacitive Reactance**. This capacitive reactance is inversely proportional to frequency and produces the opposition to current flow around a capacitive AC circuit as we looked at in the *AC Capacitance* tutorial in the AC Theory section.

Capacitor Tutorial Summary

A capacitor consists of two metal plates separated by a dielectric.

The dielectric can be made of many insulating materials such as air, glass, paper, plastic etc.

A capacitor is capable of storing electrical charge and energy.

The higher the value of capacitance, the more charge the capacitor can store.

The larger the area of the plates or the smaller their separation the more charge the capacitor can store.

A capacitor is said to be "Fully Charged" when the voltage across its plates equals the supply voltage.

The symbol for electrical charge is Q and its unit is the Coulomb.

Electrolytic capacitors are polarized. They have a +ve and a -ve terminal.

Capacitance is measured in **Farads**, which is a very large unit so **micro-Farad** (uF), **nano-Farad** (nF) and **pico-Farad** (pF) are generally used.

The Experimenters Bench

Capacitors that are daisy chained together in a line are said to be connected in **Series**.

Capacitors that have both of their respective terminals connected to each terminal of another capacitor are said to be connected in **Parallel**.

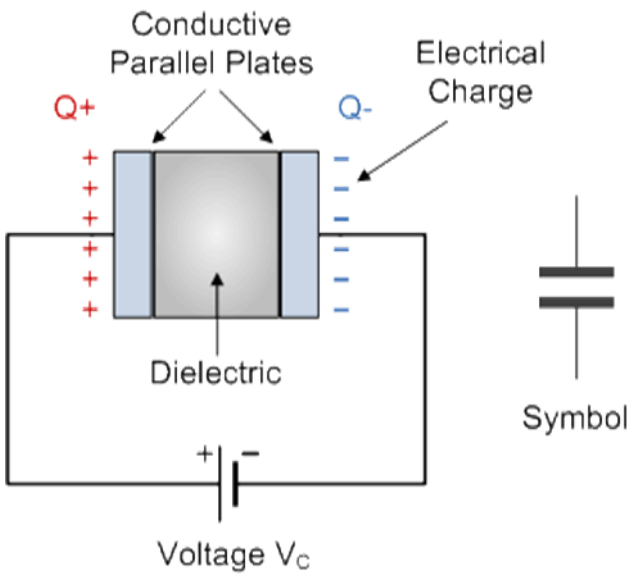
Parallel connected capacitors have a common supply voltage across them.

Series connected capacitors have a common current flowing through them.

Capacitive reactance is the opposition to current flow in AC circuits.

In AC capacitive circuits the voltage "lags" the current by 90°.

The basic construction and symbol for a parallel plate capacitor is given as:



Early Radio: Military Communications

A day with Delta Co. 1st of the 9th Marines.

It was November of 1965, I had been in Vietnam for only a few weeks, and I wanted to see some action. After all I had reenlisted after being out of the Corps for just over two years, and I felt that I had been cheated, not having had a hot war while I was in the Crotch the first time. I was determined to make up for lost time. My MOS was 2111 Armor assigned to the 1st Battalion 9th Marines in the Supply Platoon and not likely to see much action.

I was volunteering for every opportunity to get out of the Old French Fort we were occupying at Marble Mountain; I wanted to see for myself what was going on.

MAG 16 had been overrun a month earlier and they were still short of helicopters. The Battalion was re-supplying the grunts in the field with Am tracks as much as possible, trying to take some of the load off the helicopters at MAG 16. The VC were starting to plant mines on the roads at night, denying Highway One to us south past the water point.
When an Amtrak showed up at our little French Fort and was being loaded for a resupply run to Delta Company who was operating in the Horse Shoe Lake area, about five miles south. I jumped at the chance when a lieutenant who was the track commander asked for an extra rifleman to come along. As rifleman go, I considered myself among the best.

My father gave me a single shot 22 when I was eleven years old. Being a farm boy in south Texas I had lots of opportunity to shoot and I was very good with that 22, soon moving up to a 45/70 when I was fourteen. In boot camp I was the Outstanding Marksman with my M1, placing first out of 120 marine boots, not bad. I frankly felt a little sorry for the VC if they tried to pull anything while I was there. My lieutenant said OK when I asked to be the extra rifleman, he seemed happy to get rid of me for some reason. We loaded the Amphibious Tractor with C rats, water and ammunition for Delta Co. and in addition we had candy and toys for the Vietnamese kids. The plan was to take Hwy One to the water point and turn east for about a half mile to the beach and make the five mile leg of our trip south on the beach, because it was hard for the VC to plant mines in the wet salty sand. The lieutenant said they had gone that way before and the only problem he anticipated was the leg of our trip from the beach back to the west to locate Delta Co. The trip to delta was as he said it would be. A nice ride on the beach and when we turned west we were not quite sure where we were in reference to Delta and stopped to radio and fire a flair for recognition. They could not hear us or see our red star cluster flair, so we pushed on for another half mile and tried again.

Early Radio: Military Communications

This time they said they could hear us at a distance and gave the track commander a rough heading, we located them soon enough. We were at the headquarters section of Delta with one Platoon and they were positioned on top of a small hill where the officers had a bunker of wood constructed in the sandy soil at the top. The hill was about 30 feet above the surrounding terrain and was almost void of vegetation. They had some Concertina wire and fighting holes on the small parameter, not much to look at but at least they had the high ground. Well we were there for about three hours, and after we unloaded the track I had some time to look around the place. While talking to the grunts I was told about an incident that happened a few weeks ago. As told to me, "the platoon commander came over to their Squad Leader who was in charge of that part of the line and told them that there will not be any firing into the dark just "stay awake" he said.

If you do some shooting, you better have a body to show me in the morning, and don't be shooting the parachute flairs, we are almost out of them. During the night they begin to here sounds that sounded like someone was trying to get through the wire. The sound was so faint that they were not at all that sure they were not imagining it. They were short on flares and the Lt had said he would have there asses if they used the flairs just to see some imagined enemy. They listened for a definite indication that some one was in the wire but all they heard was some faint and not distinct sound. After a while the Squad Leader said, to hell with the lieutenant and fired a parachute flare into the air and nothing was there, nothing but a lonely little bush all by its self just inside the wire. The flair was swinging back and forth causing shadows to dance in the dark, and as the flair came down the shadows began to get longer and the marines started dreading the lieutenant's reaction in the morning.

The flare was beginning to sputter its last breath when the Squad Leader said, "what the hell, we are already in trouble, shoot the bush". All eight marines of his squad opened up with their M14s, all at the same. In a blink of an eye other marines around the little hill started shooting out in all directions and popping flairs and it was a sight to see while it lasted. The firing stopped as quick as it had started and all that was heard was the Lieutenant shouting from his bunker that you bastards better have a body to show me in the morning.

It was a long night and the marines began to talk about what happened saying things like "what the hell, what can he do, send us to Vietnam"? We have a right to see if something is out there when we hear the cans in the wire jingle, isn't that right? The next morning they went down to the wire to check and found to their surprise the body of one screwed up dead little VC with about 20 holes in him and two Chicom grenades.

They were so happy to have found this poor little guy that they grabbed him by his feet and dragged him to the command bunker to show the Lieutenant. He came out and said to this group of very happy marines, "good work" and ordered them to dig a hole and bury him. He disappeared back into his hole and his order did not go well with marines who thought they had just done a good thing. His order seemed more like punishment. One of them complained "we just finished digging the hole for the 4 hole crapper and now we have to dig another one. A light came on and they all looked at each other at the same time; no one said a word as they began to drag this little sapper over to the 4 holler.

They worked as a team, no one had to say anything when they got to the 4 holler the two lead marines lifted the top off and four marines dumped the body in feet first causing him to fold up in the setting position half in and half out down in the muck, back on goes the top and they slink off to their fighting holes, hopping no one noticed. Looking back after reaching their side of the hill they see a line already forming at the 4 holler. Marines were starting to try and bomb the poor guy.

They heard things like, "wow I got him in the head and hurry up, let my try". The lieutenant never found out where they buried the VC and never asked. Perhaps he didn't want to know. One thing is for sure, if you screw with Delta Co. 1/9 you can end up in deep shit".

After hearing that story I will never set on a 4 holer without thinking about Delta Co. As I was looking at the area around the hill I was impressed by the beauty of the surrounding terrain when I noticed a H34 helicopter heading toward our position, getting closer and I realized the thing was going to land on this little hill. The helicopter kicked up a sand storm while landing and when the dust settled I saw a beautiful blond women standing in the door wearing a mini skirt and hi heal shoes. One of the officers came running out of the bunker to help her out of the helicopter.

Early Radio: Military Communications

She jumped from the door and her feet sank deep into the sand, as she stepped away she lost her hi hell shoes disappearing under the sand. More officers came out laughing and talking and they all disappeared back into the bunker as fast as they came out. Not a word was said and no one had to use their imagination to figure out what was probably going on in that command bunker, officer's prerogative I guess. Next out of the H34 came some hot food containers of shrimp, lobster, baked potatoes, hot coffee, and coolaid. We soon forgot about the blond, and we ate all we could. After finishing this fantastic lunch I was licking my lips and asked "what's the occasion". Someone said, it's the Marine Corps Birthday, I had no idea. It was November 10, 1965 and marines all over the world were celebrating the Marine Corps Birthday. In about an hour we loaded up the Chopper blond and all, except for her hi heel shoes and off they went back to Da Nang.

As soon as the helicopter left I was on the Am Track and we were heading east, on a different route back to the beach. It was early afternoon and the cool breeze coming off the South China Sea felt great and we were in a relaxed mood. The big V12 engine was making so much noise that you could not hear yourself think, even so, after my ears got numb enough the ride was actually enjoyable. The driver was in his seat with his head and shoulders sticking out of his position at the front left side of the track. The commander was inside with his hatch open and the two other crew members were on top with me.

The janitor (nickname given to the track mechanic) was setting in the center with his legs hanging over the front of the track his 45 cal. grease gun in his lap when a single round from the sand dunes came over the drivers head and hit the janitor in the left temple exiting out the right temple. He fell back, blood spurting out all over the toys. We came to a halt, the Lieutenant started trying to revive the janitor and instantly realized that he was dead and it was useless to try. Another round came past us from the sand dunes, this time he was shooting at me. I felt the round passing the right side of my head with a popping sound. The lieutenant was mad as hell and ordered the big machine turned toward the dunes and he said "let's get the bastard". As the track started moving he ordered us to open fire, the machine gunner in the turret started firing. I could not see what to shoot at but started firing into the direction I thought the sniper was when both weapons jammed. With the only fire power we had on top of the Am Track out of action the lieutenant ordered a quick turn back north. As we sped away we started taking a very large volume of fire from the sand dunes. .

It was obvious the sniper was not alone and they had apparently held there fire hopping that we would go into he dunes where they had plans to do us in. As I looked around I saw the hatches were closed and I was the only one left alive on top. I was on my own, so I took cover behind a role of steel cable I laid flat on my back using what little cover the cable provided.

I turned my head to the right putting it flatter on the steel deck, trying to expose less of myself. As I looked out into the surf I saw lots of water kicking up in the surf from the fire we were taking. I could hear rounds hitting the side of the track and it sounded muffled like rain because of the overwhelming noise the big V12 engine was making at full power. We were soon out of range and tried to report to radio Battalion but the radio was not working, so we made our way as fast as we could to the water point where we knew a land line would allow us to report the incident to battalion. Later back in the Battalion area, the Am Track crew counted over a hundred hits on the left side of the big vehicle, and we also received word from Delta Co. that they sent a platoon to investigate the fire fight as soon as they heard it. They reported finding evidence of a U shaped ambush in the sand dunes estimated to be about platoon sized.

Investigating the weapons I found a faulty magazine that caused my M14 to jam and the light 30 on the track was caused by improper head space. I am sure the VC would have killed us all, if we were to have charged into the trap they set up. You have to wonder about small things that cause the outcome to be as different as night and day. All I can say is, luck was on our side this time, except for the janitor that is. My marksmanship abilities were not of any value at all and even if my M14 had worked perfectly I didn't see anything to shoot at. I had a lot to learn in this war, that is the plane truth. Back at the old French Fort I had a talk with my friend Paul Vanover like me he had reenlisted and asked for Vietnam. We both went to our platoon leader and volunteered for infantry duty. He relayed the request to Battalion and they said they needed Scouts. We both accepted the offer.

George Strodtman, S2 Scout

Wisconsin Traffic Nets

Name of Net, Frequency, Local Time	Net Manager
Badger Weather Net (BWN) 3984 kHz, 0500	W9IXG
Badger Emergency Net (BEN) 3985 kHz, 1200	NX9K
Wisconsin Side Band Net (WSBN) 3985 or 3982.5 kHz, 1700	KB9KEG
Wisconsin Novice Net (WNN) 3555 kHz, 1800	KB9ROB
Wisconsin Slow Speed Net (WSSN) 3555 kHz, Sn, T, Th, F, 1830	N1KSN
Wisconsin Intrastate Net - Early (WIN-E) 3555 kHz, 1900	WB9ICH
Wisconsin Intrastate Net - Late (WIN-L) 3555 kHz, 2200	W9RTP
ARES/RACES Net	WB9WKO
* Net Control Operator needed. Contact Net Manager for information.	

Next Regular Meeting

The next meeting will be on Thursday, November 29th at 7:00PM. We meet in the Fellowship Hall of Redemption Lutheran Church, 4057 N Mayfair Road. Use the south entrance. Access the MRAC Yahoo group for important details about the February Meeting.

Meeting Schedule:

November 29th, 2012

January 31st, 2013

February 28th, 2013

SwapFest: February 16th, 2013

Please do not call the church for information!

Club Nets

Please check in to our nets on Friday evenings.

Our ten meter SSB net is at **8:00 p.m.** at **28.490 MHz USB** Our two meter FM net follows at **9:00 p.m**. on our repeater at **145.390 MHz** with a minus offset and a **PL of 127.3 Hz.**

Visit our website at: **www.w9rh.org**

Or phone (414) 332-MRAC or 332 - 6722

Chatter Deadline

The **DEADLINE** for items to be published in the **Chatter** is the 15th of each month. If you have anything (announcements, stories, articles, photos, projects) for the 'Chatter, please get it to me before then.

You may contact me or Submit articles and materials by e-mail at: **Kc9cmt@earthlink.net**

or by Post to:

Michael B. Harris

807 Nicholson RD

South Milwaukee, WI 53172-1447

VE Testing:

October 27th, 2012—AES 9:30 am to 11:30 am.
November 24th, 2012—AES 9:30 am to 11:30 am.

ALL testing takes place at: Amateur Electronic Supply 5720 W. Good Hope Rd. Milwaukee, WI 53223

Area Swapfests

Jan. 5th, 2013 41st Annual Midwinter Swapfest Location: Waukesha, WI Type: ARRL Hamfest
Sponsor: West Allis Radio Amateur Club
Website: http://www.warac.org

Jan. 20th, 2013 WCRA Mid-Winter Hamfest Location: St. Charles, IL Type: ARRL Hamfest
Sponsor: Wheaton Community Radio Amateurs
Website: http://www.w9ccu.org

February 16th, 2013 Mid-Winter Interclub SwapFest

Location: Brookfield, WI Type: ARRL Hamfest
Sponsor: Milwaukee Radio Amateurs Club & Milwaukee Area Amateur Radio Society

Website: http://www.w9rh.org

MRAC Working Committees

95th Anniversary:

- Dave—KA9WXN

Net Committee:

- Open

Field Day

Dave—KA9WXN, Al—KC9IJJ

FM Simplex Contest

- Joe – N9UX
- Jeff – K9VS

Ticket drum and drawing

- Tom – N9UFJ
- Jackie – No Call

Newsletter Editor

- Michael-KC9CMT

Webmaster

- Mark Tellier—AB9CD

Refreshments

- Hal—KB9OZN

Membership Information

The Hamateur Chatter is the newsletter of MRAC (Milwaukee Radio Amateurs' Club), a not for profit organization for the advancement of amateur radio and the maintenance of fraternalism and a high standard of conduct. MRAC Membership dues are $17.00 per year and run on a calendar year starting January 1st. MRAC general membership meetings are normally held at 7:00PM the last Thursday of the month except for November when Thanksgiving falls on the last Thursday when the meeting moves forward 1 week to the 3rd Thursday and December, when the Christmas dinner takes the place of a regular meeting. Club Contact Information

Our website address **http://www.w9rh.org**

Telephone **(414) 332-MRAC (6722)**

Address correspondence to:

MRAC, Box 240545, Milwaukee, WI 53223

Email may be sent to: **w9rh@arrl.net .** Our YAHOO newsgroup:

http://groups.yahoo.com/group/MRAC-W9RH/

CLUB NETS:

- The Six Meter SSB net is Thursday at 8:00PM on 50.160 MHz USB
- Our Ten Meter SSB net is Friday at 8:00PM on 28.490 MHz ± 5 KHz USB.
- Our Two Meter FM net follows the Ten meter net at 9:00PM on our repeater at 145.390MHz - offset (PL 127.3)

The HamChatter is a monthly publication of the Milwaukee Radio Amateurs' Club.
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MRAC Website: http://www.W9RH.org
Editor: Michael B. Harris, Kc9cmt, kc9cmt@Earthlink.net

Milwaukee Area Nets

Mon.8:00 PM 3.994 Tech Net

Mon.8:00 PM 146.865- ARES Walworth ARRL News Line

Mon.8:00 PM 146.445 Emergency Net

Mon.8:00 PM 146.865- ARES Net Walworth

Mon.8:45 PM 147.165- ARRL Audio News

Mon. 9:15 PM 444.125+ Waukesha ARES Net

Mon.9:00 PM 147.165- Milwaukee County ARES Net

Tue.9:00 AM 50.160 6 . Mtr 2nd Shifter's Net

Tue. 7:00 PM 145.130 MAARS Trivia Net

Tue. 8:00 PM 7.035 A.F.A.R. (CW)

Wed. 8:00 PM 145.130 MAARS Amateur Radio Newsline

Wed. 9:00 PM 145.130 MAARS IRLP SwapNet d FM-38 Repeaters (IRLP 9624)

Thur. 8:00 PM 50.160, 6 Mtr SSB Net

Thur. 9:00 PM 146.910 Computer Net

Fri. 8:00 PM 28.490 MRAC W9RH 10 Mtr Net SSB

Fri. 9:00 PM 145.390 W9RH 2 Mtr. FM Net

Sat. 9:00 PM 146.910 Saturday Night Fun Net

Sun 8:30 AM 3.985 QCWA (Chapter. 55) SSB Net

Sun 9:00 AM 145.565 X-Country Simplex Group

Sun 8:00 PM 146.91 Information Net

Sun 8:00 PM 28.365 10/10 International Net (SSB)

Sun 9:00 PM 146.91 Swap Net