ELECTRONIC FORMULAS

Ohm's Law Formulas for D-C Circuits.

$$E = IR = \frac{P}{I} = \sqrt{PR} \qquad P = I^2R = EI = \frac{E^2}{R}$$

Ohm's Law Formulas for A-C Circuits and Power Factor.

$$E = IZ = \frac{P}{I\ \cos\Theta} = \sqrt{\frac{P\ Z}{\cos\Theta}} \qquad P = I^2\ Z\ \cos\Theta = IE\ \cos\Theta = \frac{E^2\ \cos\Theta}{Z}$$

In the above formulas Θ is the angle of lead or lag between current and voltage and cos Θ = P/EI = power factor or *pf*.

$$pf = \frac{Active\ power\ (in\ watts)}{Apparent\ power\ (in\ volt-amps)} = \frac{P}{EI} \qquad pf = \frac{R}{Z}$$

Note: Active power is the "resistive" power and equals the equivalent heating effect on water.

Voltage/Current Phase Rule of Thumb Remember "ELI the ICE man"

ELI: Voltage (E) comes before (leads) current (I) in an inductor (L)
ICE: Current (I) comes before (leads) Voltage (E) in a capacitor (C)

Resistors in Series $R_{total} = R_1 + R_2 = R_3 + ...$

Two Resistors in Parallel $R_t = \frac{R_1\ R_2}{R_1 + R_2}$ **Resistors in Parallel, General Formula**

$$R_{total} = \frac{1}{\frac{1}{R_1}+\frac{1}{R_2}+\frac{1}{R_3}+...}$$

Resonant Frequency Formulas *Where in the second formula f is in kHz and L and C are in microunits.

$$f = \frac{1}{2\pi\sqrt{LC}}\ ,\quad or\quad f = \frac{159.2*}{\sqrt{LC}} \qquad L = \frac{1}{4\pi^2 f^2 C}\ ,\quad or\quad L = \frac{25{,}330*}{f^2 C} \qquad C = \frac{1}{4\pi^2 f^2 L}\ ,\quad or\quad C = \frac{25{,}330*}{f^2 L}$$

Conductance $G = \frac{1}{R}$ $(for\ D-C\ circuit)$ $G = \frac{R}{R^2+X^2}$ $(for\ A-C\ circuit)$

Reactance Formulas $X_C = \frac{1}{2\pi f C}$ $C = \frac{1}{2\pi f X_C}$ $X_L = 2\pi f L$ $L = \frac{X_L}{2\pi f}$

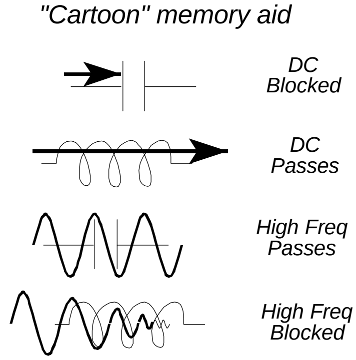
Impedance Formulas $Z = \sqrt{R^2+(X_L-X_C)^2}$ $(for\ series\ circuit)$ $Z = \frac{RX}{\sqrt{R^2+X^2}}$ $(for\ R\ and\ X\ in\ parallel)$

Q or Figure of Merit $Q = \frac{X_L}{R}$ or $\frac{X_C}{R}$

Frequency Response

	Inductor *	Capacitor *	Resister
DC	Pass	Block	Attenuate
Low Freq AC	Attenuate *	Attenuate *	Attenuate
High Freq	Block	Pass	Attenuate

* Attenuation varies as a function of the value of the each device and the frequency



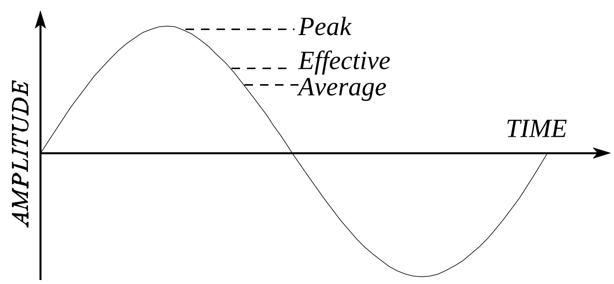
Sinusoidal Voltages and Currents

Effective value = 0.707 x peak value
[Also known as Root-Mean Square (RMS) value]

Half Cycle Average value = 0.637 x peak value

Peak value = 1.414 x effective value

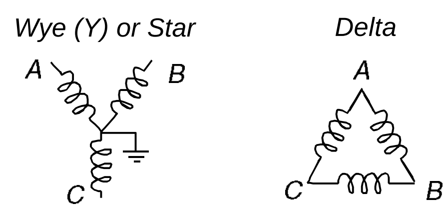
∴ Effective value = 1.11 x average value



Three-phase AC Configurations

(120° phase difference between each voltage)

If the connection to a three phase AC configuration is miswired, switching any two of the phases will put it back in the proper sequence. Electric power for ships commonly uses the delta configuration, while commercial electronic and aircraft applications commonly use the wye configuration.



Color Code for House Wiring:	PURPOSE:	Color Code for Chassis Wiring:
Black or red	HOT	Red
White	NEUTRAL (Return)	White
Green or bare	GROUND	Black

Color Code for Resistors: First and second band:
(and third band # of zeros if not gold/silver)

0	Black	5	Green
1	Brown	6	Blue
2	Red	7	Violet
3	Orange	8	Gray
4	Yellow	9	White

Third band
Multiplier

.1	Gold
.01	Silver

Fourth band
Tolerance

5%	Gold
10%	Silver
20%	No color

The third color band indicates number of zeros to be added after figures given by first two color bands. But if third color band is gold, multiply by 0.1 and if silver multiply by 0.01. Do not confuse with fourth color-band that indicates tolerance. Thus, a resistor marked blue-red-gold-gold has a resistance of 6.2 ohms and a 5% tolerance.