ELECTRONICS GUIDE

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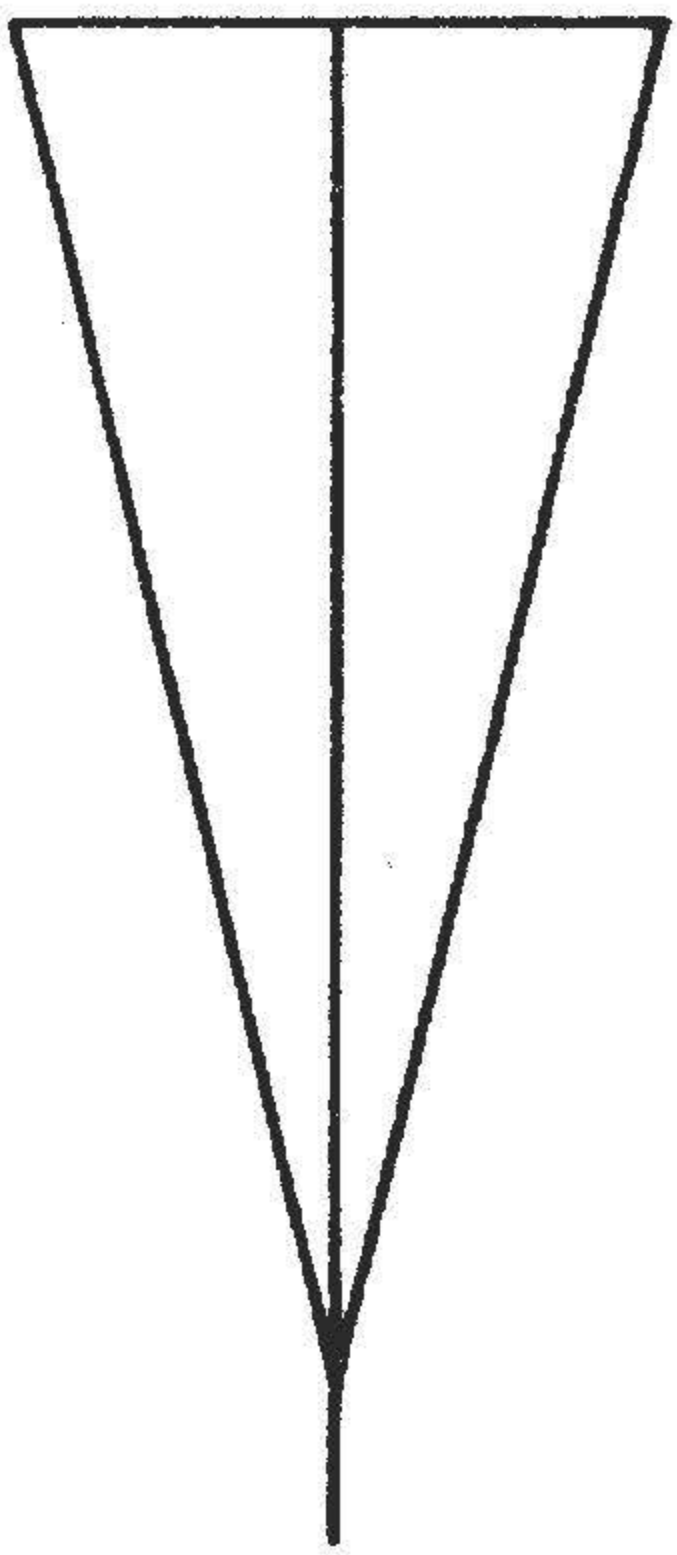


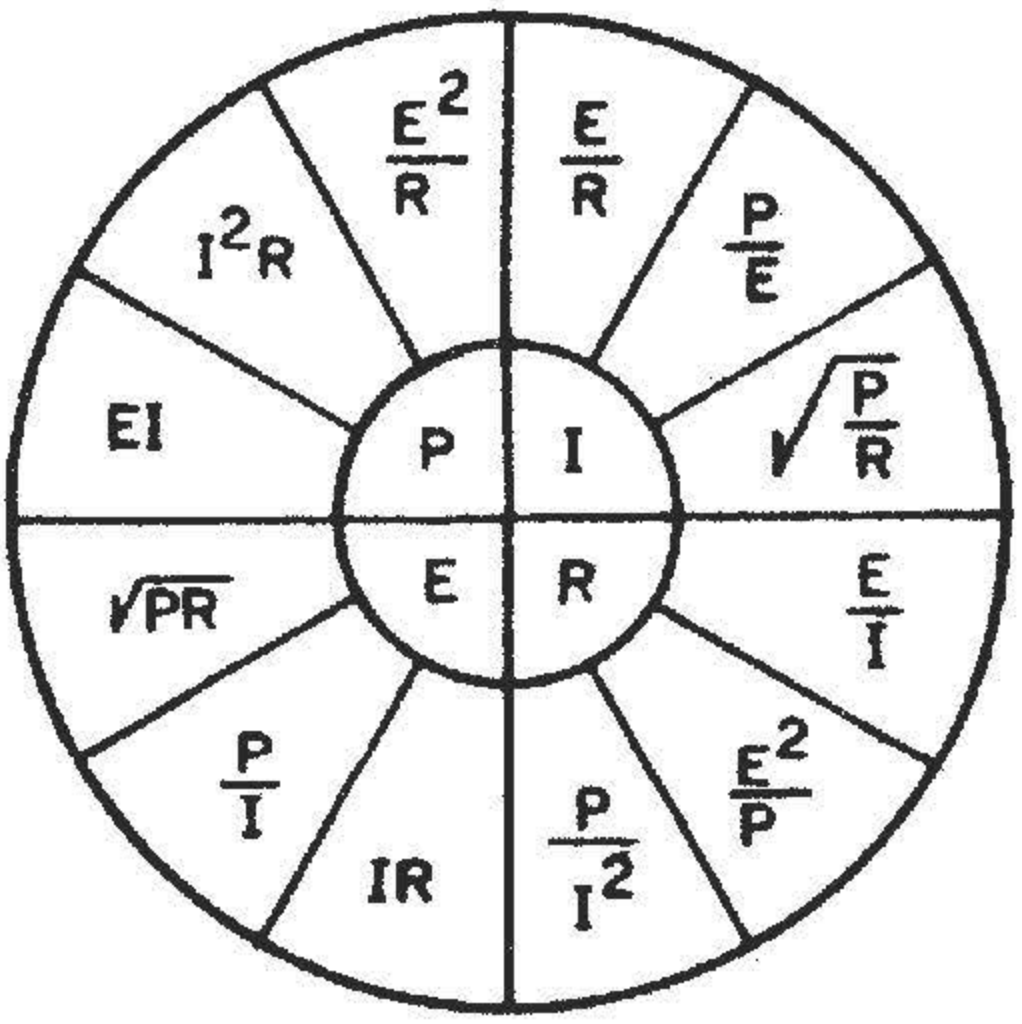
A GUIDE TO
COMMONLY USED CONVERSION FACTORS,
FORMULAS, TABLES AND COLOR CODES.

(1) CONVERSION FACTORS AND CONSTANTS

$\pi = 3.14$	$2\pi = 6.28$
$\pi^2 = 9.87$	$(2\pi)^2 = 39.5$
$\epsilon = 2.718$	$\sqrt{2} = 1.414$
$\sqrt{3} = 1.732$	$\text{LOG}\ \pi = 0.497$

1 METER = 39.37 INCHES = 3.28 FEET
1 KILOMETER = 0.621 MILE (ABOUT 3/5 MILE)
1 INCH = 2.54 CENTIMETERS
1 KILOGRAM = 2.2 POUNDS
1 LITER = 1.06 QUARTS
1 OUNCE = 28.35 GRAMS
1 HORSEPOWER = 746 WATTS

(2) OHM'S LAW FORMULAS FOR DC CIRCUITS



(3) OHM'S LAW FORMULAS FOR AC CIRCUITS

SERIES CIRCUITS

SERIES	PARALLEL
$Z = \sqrt{R^2+(X_L-X_C)}$	$Z = \frac{E_A}{I_t}$
$E = IZ$	$E = IZ$
$I = \frac{E}{Z}$	$I_t = \sqrt{I_R^2+(I_L-I_C)^2}$
$AP = I^2Z$	$AP = E_AI_t$
$TP = I_R^2R$	$TP = I_R^2R$
$PF = \frac{R}{Z}$	$PF = \frac{TP}{AP}$
$E_R = IR$	$E_R = I_RR$
$E_L = IX_L$	$E_L = I_LX_L$
$E_C = IX_C$	$E_C = I_CX_C$
$I_R = \frac{ER}{R}$	$I_R = \frac{E}{R}$

$$I_L = \frac{E_L}{X_L} \qquad I_L = \frac{E}{X_L}$$

$$I_C = \frac{E_C}{X_C} \qquad I_C = \frac{E}{X_C}$$

$$E_A = \sqrt{E_R^2 + (E_L - E_C)^2} \qquad E_A = I_t Z_t$$

(4) RESISTORS IN SERIES

$$R_{total} = R_1 + R_2 + R_3 + \cdots\cdots\cdots$$

(5) TWO RESISTORS IN PARALLEL

$$R_t = \frac{R_1 R_2}{R_1 + R_2} \qquad R_1 = \frac{R_t R_2}{R_2 - R_t}$$

(6) EQUAL RESISTORS IN PARALLEL

$R_{total} = \frac{R}{n}$, WHERE n IS THE NUMBER OF RESISTORS

(7) RESISTORS IN PARALLEL, GENERAL FORMULA

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

(8) SINUSOIDAL VOLTAGES AND CURRENTS

EFFECTIVE VALUE = 0.707 X PEAK VALUE
AVERAGE VALUE = 0.637 X PEAK VALUE
PEAK VALUE = 1.414 X EFFECTIVE VALUE
EFFECTIVE VALUE = 1.11 X AVERAGE VALUE
PEAK VALUE = 1.57 X AVERAGE VALUE
AVERAGE VALUE = 0.9 X EFFECTIVE VALUE

(9) CONDUCTANCE, SUSCEPTANCE, AND ADMITTANCE

$G = \frac{1}{R}$ (FOR D-C CIRCUIT)

$G = \frac{R}{R^2 + X^2}$ (FOR A-C CIRCUIT)

$B = \frac{1}{X}$ (WHEN RESISTANCE IS 0)

$$B = \frac{X}{R^2 + X^2}$$

$$Y = \frac{1}{Z} = \frac{1}{\sqrt{R^2 + X^2}}$$

(10) REACTANCE FORMULAS

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

$$X_L = 2\pi f L \qquad L = \frac{X_L}{2\pi f}$$

(11) RESONANT FREQUENCY FORMULAS

$$f = \frac{1}{2\pi\sqrt{LC}} \text{, OR } f = \frac{159.2^*}{\sqrt{LC}}$$

$$L = \frac{1}{4\pi^2 f^2 C} \text{, OR } L = \frac{25{,}330^*}{f^2 C}$$

$$C = \frac{1}{4\pi^2 f^2 L} \text{, OR } C = \frac{25{,}330^*}{f^2 L}$$

* WHERE IN THE SECOND FORMULA f IS IN kc AND L AND C ARE IN MICROUNITS.

(12) IMPEDANCE FORMULAS

$$Z = \sqrt{R^2 + (X_L - X_C)^2} \text{ (FOR SERIES CIRCUIT)}$$

$$Z = \frac{RX}{\sqrt{R^2 + X^2}} \text{ (FOR R AND X IN PARALLEL)}$$

(13) POWER FACTOR

pf = COS θ, WHERE θ IS THE ANGLE OF LEAD OR LAG

$$pf = \frac{\text{TRUE POWER}}{\text{APPARENT POWER}} = \frac{P}{EI}$$

$$pf = \frac{R}{Z}$$

(14) Q OR FIGURE OF MERIT

$$Q = \frac{X_L}{R} \text{ OR } \frac{X_C}{R}$$

(15) TRANSFORMER RELATIONSHIPS

$$\frac{N_P}{N_S} = \frac{E_P}{E_S} = \frac{I_S}{I_P} = \sqrt{\frac{Z_P}{Z_S}}$$

(16) EFFICIENCY (FOR ANY DEVICE)

$$EFF = \frac{\text{OUTPUT}}{\text{INPUT}}$$

(17) DECIBEL FORMULAS

WHEN IMPEDANCES ARE EQUAL,

$$db = 10 \log \frac{P_1}{P_2} = 20 \log \frac{E_1}{E_2} = 20 \log \frac{I_1}{I_2}$$

WHEN IMPEDANCES ARE UNEQUAL,

$$db = 10 \log \frac{P_1}{P_2} = 20 \log \frac{E_1\sqrt{Z_2}}{E_2\sqrt{Z_1}} = 20 \log \frac{I_1\sqrt{Z_1}}{I_2\sqrt{Z_2}}$$

DECIBEL TABLE

DB	POWER RATIO	VOLTAGE OR CURRENT RATIO	DB	POWER RATIO	VOLTAGE OR CURRENT RATIO
0	1.00	1.00	10	10.0	3.2
0.5	1.12	1.06	15	31.6	5.6
1.0	1.26	1.12	20	100	10
1.5	1.41	1.19	25	316	18
2.0	1.58	1.26	30	1,000	32
3.0	2.00	1.41	40	10,000	100
4.0	2.51	1.58	50	10^5	316
5.0	3.16	1.78	60	10^6	1,000
6.0	3.98	2.00	70	10^7	3,162
7.0	5.01	2.24	80	10^8	10,000
8.0	6.31	2.51	90	10^9	31,620
9.0	7.94	2.82	100	10^{10}	10^5

(18) FREQUENCY AND WAVELENGTH

$$f_{kc} = \frac{3 \times 10^5}{\lambda_{METER}} \qquad \lambda_{METER} = \frac{3 \times 10^5}{f_{kc}}$$

$$f_{Mc} = \frac{3 \times 10^4}{\lambda_{CENTIMETER}} \qquad \lambda_{CM} = \frac{3 \times 10^4}{f_{Mc}}$$

$$f_{Mc} = \frac{984}{\lambda_{FEET}} \qquad \lambda_{FEET} = \frac{984}{f_{Mc}}$$

(19) LENGTH OF ANTENNAS

FORMULAS ASSUME VELOCITY OF PROPAGATION EQUAL TO 95% OF THE VELOCITY OF LIGHT.

$$L_{FEET} = \frac{234}{F_{Mc}} \text{ (FOR QUARTER-WAVE ANTENNA)}$$

$$L_{FEET} = \frac{468}{F_{Mc}} \text{ (FOR HALF-WAVE ANTENNA)}$$

(20) COLOR CODE

0	BLACK	4	YELLOW	8	GRAY
1	BROWN	5	GREEN	9	WHITE
2	RED	6	BLUE	5%	GOLD
3	ORANGE	7	VIOLET	10%	SILVER
		20%	NO COLOR		

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.

(21) COLOR CODE FOR POWER TRANSFORMERS

PRIMARY LEADS	—	BLACK OR BLACK-RED
PRIMARY TAP	—	BLACK-YELLOW
HIGH VOLTAGE WINDING	—	RED (C.T.-RED-YELLOW)
RECTIFIER FILAMENT	—	YELLOW (C.T.-YELLOW-BLUE)
AMPLIFIER FIL. NO. 1	—	GREEN (C.T.-GREEN-YELLOW)
AMPLIFIER FIL. NO. 2	—	BROWN (C.T.-BROWN-YELLOW)
AMPLIFIER FIL. NO. 3	—	SLATE (C.T. - SLATE-YELLOW)

(22) COLOR CODE FOR BATTERY CABLE

A+	RED	B(INTERMEDIATE)	WHITE
A-	BLACK	C+	BROWN
B+	BLUE	C(INTERMEDIATE)	ORANGE
B-	YELLOW	C-	GREEN

(23) COLOR CODE, I.F. TRANSFORMERS

PRIMARY PLATE	BLUE
PRIMARY B+	RED
SECONDARY GRID OR DIODE	GREEN
GRID OR DIODE RETURN	BLACK

(24) COLOR CODE FOR CHASSIS WIRING

BLACK	—	GROUNDS, GROUNDED ELEMENTS, AND RETURNS.
BROWN	—	HEATERS OR FILAMENTS, OFF GROUND.
RED	—	POWER SUPPLY B+.
ORANGE	—	SCREEN GRIDS.
YELLOW	—	CATHODES.
GREEN	—	CONTROL GRIDS.
BLUE	—	PLATES.
GRAY	—	A-C POWER LINES.
WHITE	—	ABOVE OR BELOW GROUND RETURNS, A.V.C., ETC.

(25) COLOR CODE FOR AF AND OUTPUT TRANSFORMERS

BLUE	—	PLATE (FINISH) LEAD OF PRIMARY.
RED	—	B+ (THIS APPLIES WHETHER PRIMARY IS PLAIN OR CENTER-TAPPED).
BROWN	—	PLATE (START) LEAD ON C.T. PRIMARIES. (BLUE MAY BE USED FOR THIS LEAD IF POLARITY IS NOT IMPORTANT.)
GREEN	—	GRID (FINISH) LEAD OF SECONDARY (HOT END OF VOICE COIL).
BLACK	—	GRID RETURN (THIS APPLIES WHETHER SECONDARY IS PLAIN OR c-t).
YELLOW	—	GRID (START) LEAD ON c-t SECONDARIES. (GREEN MAY BE USED FOR THIS LEAD IF POLARITY IS NOT IMPORTANT.)

(26) COLOR CODE FOR LOUDSPEAKERS

FIELD COILS
- BLACK AND RED — START.
- YELLOW AND RED — FINISH.
- SLATE AND RED — TAP (IF USED).

VOICE COILS
- BLACK — START.
- GREEN — FINISH.

TRANSFORMER PRIMARIES
- BLUE OR BROWN — START.
- BLUE — FINISH.
- RED — CENTER TAP.

NOTE: IF TWO FIELD COILS ARE FITTED TO THE SAME LOUDSPEAKER, THE BASIC COLOR CODING IS USED FOR THE LOWER RESISTANCE FIELD, AND GREEN IS SUBSTITUTED FOR THE RED IN THE HIGHER RESISTANCE FIELD.

(27) TIME DURATION OF ONE CYCLE

100 kc	— 10 μsec
200 kc	— 5 μsec
250 kc	— 4 μsec
1 mc	— 1 μsec
4 mc	— 0.25 μsec
10 mc	— 0.1 μsec

(28) COUPLED INDUCTANCE

(M = MUTUAL INDUCTANCE;
K = COEFFICIENT OF COUPLING)

$$L_t = L_1 + L_2 \pm 2M$$

$$K = \frac{M}{\sqrt{L_1 L_2}}$$

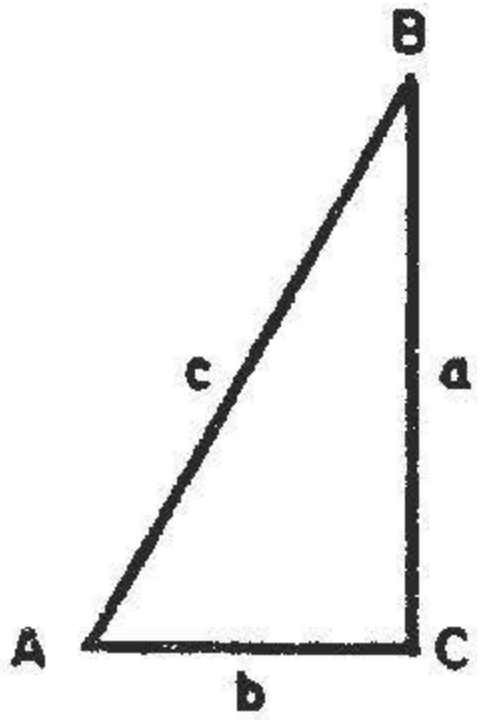
(29) TRIGONOMETRIC FORMULAS

$$\sin A = \frac{a}{c} = \frac{\text{OPPOSITE SIDE}}{\text{HYPOTENUSE}}$$

$$\cos A = \frac{b}{c} = \frac{\text{ADJACENT SIDE}}{\text{HYPOTENUSE}}$$

$$\tan A = \frac{a}{b} = \frac{\text{OPPOSITE SIDE}}{\text{ADJACENT SIDE}}$$

$$\cot A = \frac{b}{a} = \frac{\text{ADJACENT SIDE}}{\text{OPPOSITE SIDE}}$$



FOR FURTHER
INFORMATION
AND
ASSISTANCE

SEE
YOUR LOCAL
FTD/MTD