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## SYMBOLS

AT	adjective describing a rotated Y cut plate operating on the thickness-shear mode, the plane of the plate making an angle of approximately $35^\circ$ with the Z crystallographic axis (pp. 16, 77-79)
C	capacitance
$C_{1,3,5\dots n}$	equivalent motional capacitance, usually written $C_n$ if general, for any harmonic order. Numerical subscript designates harmonic order (p. 8)
$C_A$	load capacitance as used in series with resonator unit for purpose of measurement (pp. 164, 166)
$C_e$	capacitance created by electrodes, $C_e = C_o - C_h$ (p. 8)
$C_h$	shunt capacitance resulting from holder and mount, $C_h = C_o - C_e$ (p. 8)
$C_o$	total shunt capacitance of resonator, $C_o = C_e + C_h$ (p. 8)
d, D	diameter of circular quartz plate
$d_e$	diameter of circular electrode
$d_e^2/t$	ratio of the square of the diameter of the electrode to the thickness of the quartz plate, in inches, proportional to the area/thickness ratio in inches and approximately proportional to $C_e$
d/t	ratio of diameter of quartz plate to its thickness
F, f	frequency. Capital F is used when there is a change of units, as $\Delta f/F^2$ , where f is in kilocycles and F in megacycles. Except for such special cases f is in cycles per second (cps)  Subscripts 1,3,5...n,s,a, indicate frequency on fundamental, third harmonic, fifth harmonic .... fundamental or any harmonic, at series resonance, at anti-resonance
$f_{\max}$	frequency at the temperature point of an AT resonator which is called the low temperature turning point, or $T_{\max}$ (p. 82)



$f_{\min}$	frequency at the temperature point of an AT resonator which is called the high temperature turning point, or $T_{\min}$ (p. 82)
$ft$	frequency times thickness of an AT cut plate, the frequency-thickness coefficient, usually in inches and kilocycles or inches and megacycles
$g$	gravitational acceleration
$h$	henry, unit of inductance
ID	inside diameter
$k, K$	constants, defined as used
$kc$	kilocycles per second
$L_1, L_3, L_5 \dots L_n$	equivalent motional inductance on fundamental, 3rd harmonic, fifth harmonic ....fundamental or any harmonic (p. 8)
$mc$	megacycles per second
$n$	harmonic order, including 1 for fundamental, used as a subscript for identification of such parameters as motional capacitance, inductance, and resistance, or as a quantity. In the second or third place of the three digit system (p. 17), the inharmonic order
OD	outside diameter
PEM	Production Engineering Measures
ppm	parts per million
$Q$	figure of merit, $Q = \frac{1}{\omega CR}$ , or more precisely $Q = Q_s = \frac{1}{\omega_s C_n R_n}$ , where subscript s indicates series resonance (pp. 1-2)
$R, R_1, R_3, R_5 \dots R_n, R_s, R_a$	equivalent resistance, on fundamental, third harmonic, fifth harmonic, fundamental or any harmonic, at series resonance, at anti-resonance; with numerical subscripts, series resonance is understood; usually used loosely for equivalent resistance of entire unit, which includes equivalent motional resistance and resistance of holder, mount, etc. ( $R_m$ ) (p. 8)

$r$	radius of curvature of a spherically contoured quartz plate (p. 59) [ $r = C_0/C_1$ or $r = C_e/C_1$ is <u>not</u> used in this book]
$R_m$	"metallic" resistance, resonator is measured as a capacitor near but not at resonance (p. 167)
$s$	subscript for "at series resonance"
S.A.O.	synthetic aluminum oxide
$T, T_a, T_b, T_c, T_d, T_i, T_{max}, T_{min}$	Temperature; for definition of subscripts see pp. 82-83
$X$	reactance
$X$	polar or electrical crystallographic axis
$Y$	mechanical crystallographic axis
$Z$	impedance
$Z$	optic crystallographic axis
$ZZ'$	the "AT" angle or the angle which the plane of the quartz plate makes with the $Z$ crystallographic axis
$\Delta f/F^2$	ratio of change in frequency in kilocycles to square of nominal frequency in megacycles
$\Delta f/f$	ratio of change in frequency to nominal frequency, same units, parts per million
$\eta$	viscosity of gas (p. 116)
$\mu\mu f$	micromicrofarad
$\rho$	density of gas (p. 116)
$\phi_a$	used in Appendix I, same as $d$
$\phi_e$	used in Appendix I, same as $d_e$ ( $\phi_e^2/t$ in Appendix I is in mm)
$\omega$	$2\pi f$