



### Pitot-Static Calibration Flow Chart, written by Al Lawless

**Std Sea Level Conditions**  $T_o = 15^\circ\text{C} = 288.15\text{ K} = 518.7\text{ R}$

$a_o = 1116.45\text{ ft/s} = 661\text{ KTAS} = 761.14\text{ mph} = 340.3\text{ m/s}$

$P_o = 2116.22\text{ lb/ft}^2 = 29.92\text{ in.Hg} = 101325\text{ Pa}$

$\rho_o = .0023689\text{ slg/ft}^3 = 1.225\text{ kg/m}^3$

$g = 32.17\text{ ft/sec}^2 = 9.80665\text{ m/sec}^2$

#### Temperature

$K = ^\circ\text{C} + 273.15$

$R = ^\circ\text{F} + 459.67$

$^\circ\text{C} = \left[ \frac{^\circ\text{F} - 32}{9} \right] \times 5$

$^\circ\text{F} = \frac{9}{5} ^\circ\text{C} + 32$

Calculations require consistent units  
(e.g. ft/s, lb/ft<sup>2</sup>) for all inputs & outputs.

ft/s = knots x 1.68781 = mph x 1.4666

m/s = knots x .51444 = ft/s x .30386

knots = .54 x Km/hr = mph x .869

Pa = lb/ft<sup>2</sup> x 47.88 = lb/in<sup>2</sup> x .3325

#### Altitude

$H_i$

$+ \Delta H_{ic}$

$H_{ic}$

$+ \Delta H_{pc}$

$H_c$

$+ \Delta H_{pc}$

$H_c$

$+ \Delta H_{pc}$

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$H_c$

$+ \Delta H_{pc}$

$H_c$

#### Mach

$$M \equiv \frac{V_T}{a} = \frac{V_T}{a_o \sqrt{\theta}}$$

$$M(<1) = \sqrt{5 \left[ \left( \frac{q_c}{P_a} + 1 \right)^{\frac{2}{\gamma}} - 1 \right]}$$

$$q_c \equiv P_T - P_a \quad ; \quad q_{cic} \equiv P_p - P_s$$

$$\Delta P_T \equiv P_p - P_T \quad ; \quad \Delta P_s \equiv P_s - P_a$$

$\Delta P_T, \Delta P_s$  = total & static errors

Common definitions:

$P_a$  = true ambient pressure,

$P_T$  = true total pressure,

$P_s$  = instrument-corrected static press.

$P_p$  = instrument-corrected pitot press.

#### SUPERSONIC EQUATIONS

$$\frac{q_c}{P_a} = \frac{166.92 \left[ \frac{V_e}{a_o \sqrt{\delta}} \right]^7}{\left( 7 \left[ \frac{V_e}{a_o \sqrt{\delta}} \right]^2 - 1 \right)^{2.5}} - 1$$

Can replace  $\frac{V_e}{a_o \sqrt{\delta}}$  with  $M$

or replace  $\frac{V_e}{\sqrt{\delta}}$  with  $V_c$  and

replace  $P_a$  with  $P_o$

#### Sign Convention

Note that SFTE sign convention stipulates  $\Delta P_T$  and  $\Delta P_s$  are errors to be subtracted while  $\Delta H_{pc}$  and  $\Delta V_{pc}$  are corrections to be added.

