Pressure Sensor processing

Data products ps_raw and ps_rawevent contain pressure and pressure temperature raw data numbers for continuous and event data, respectively. Measurements are taken at 20Hz but they can be downlinked to Earth at various frequencies. The data files have a column for each possible retrieval frequency.

Pressure is calculated for each datum and is stored in the ps_calib and ps_calibevent files. The conversion from pressure sensor data numbers to calibrated pressure is dependent on the pressure sensor's temperature, so pressure temperature must be calculated from the raw data numbers first. Most of the time, pressure temperature is downlinked at a lower frequency than pressure, so interpolation and extrapolation is performed to fill pressure temperature gaps smaller than 16 minutes. When the gaps in pressure temperature exceed 16 minutes, no calibrated pressure is generated.

By default, pressure temperature retrieved at 0.2Hz is used to generate the calibrated pressure. If that is absent, pressure temperature at 20Hz is sought. Typically, only one of these is available for a particular time period.

Calibrated pressure data from events are always generated using pressure temperatures from the continuous data flow, regardless of whether there are pressure temperature event data for that same time period.

Finally, data are rounded to the fourth decimal, because due to the sensor resolution further precision is noise.

Pressure Temperature:

First, convert data number to resistance:

$$R = 8.8354 \times 10^{-13}x^2 + 9.1255 \times 10^{-5}x + 720.2$$

Where *x* is the raw packet value and R is in Ohms

then convert from resistance to temperature with:

$$T = 0.2536R - 253.11$$

Where *T* is in degrees Celsius

Combining to get a closed form:

$$T = 2.2407 \times 10^{-13}x^2 + 2.3142 \times 10^{-5}x - 70.47$$

Pressure Data:

First, convert raw data number to Voltage:

$$V = 7.3621 \times 10^{-7}x + 6.1504$$

Where *x* is the raw packet value and *V* is in Volts

Then convert that Voltage to pressure:

$$P = (A_0 + A_1V + A_2V^2 + A_3V^3) + (A_4 + A_5V + A_6V^2 + A_7V^3)T + (A_8 + A_9V + A_{10}V^2 + A_{11}V^3)T^2 + (A_{12} + A_{13}V + A_{14}V^2 + A_{15}V^3)T^3$$

Where *P* is in Pascals, and:

$$A_0 = 502.64279$$
$$A_1 = 39.828902$$
$$A_2 = 0.25222874$$
$$A_3 = 0.0026357433$$
$$A_4 = 0.89035643$$
$$A_5 = 0.037470336$$
$$A_6 = 0.00309779$$
$$A_7 = -0.00010892595$$
$$A_8 = 0.0042578278$$
$$A_9 = 0.00027427180$$
$$A_{10} = -3.0351027 \times 10^{-5}$$
$$A_{11} = 3.2276019 \times 10^{-6}$$
$$A_{12} = -9.8338021 \times 10^{-5}$$
$$A_{13} = -3.8652884 \times 10^{-6}$$
$$A_{14} = 3.1186376 \times 10^{-8}$$
$$A_{15} = -3.1657122 \times 10^{-8}$$