MIT/IL
Apollo Guidance and Navigation
System Test Group Memo # 715 (E, H)

To: G. P. Edmonds, Jr.

From: R. Erickson

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Subject: Block II and LEM Temperature Thermistor Resistance Values

The following represents the determination of resistance values for the Block II and LEM thermistors based on temperature range information from the MIT/IL thermal group. The expected ranges are:

	CSM	LEM
CGC/LGC	45^{o} - 130^{o} F	Same
PSA	60^{o} - 120^{o} F	60^{o} - 110^{o} F
PEA/PTA	45^{o} - 100^{o} F	45^{o} - 90^{o} F

Farenheit to centigrade conversion results in

	CSM	LEM
CGC/LGC	7.2^{o} - 54.5^{o} C	Same
PSA	15.5^{o} - 49^{o} C	15.5^{o} - 43.3^{o} C
PEA/PTA	7.2^{o} - 38^{o} C	7.2^{o} - 32.3^{o} C

The thermistor part numbers are

CGC/LGC 1006712-3
PSA, PEA/PTA 1008833

Using the nominal ratio table from drawing 1006712-3 and assuming linearity of ratio between 10 degree increments the following resistance values were interpolated and calculated by the equation:

$$R = \left[R_N \quad LR - 0.1 \, (C - C_L) \, (LR - HR) \right]$$

where:

R = thermistor resistance in K ohms at temperature C

R_N = nominal thermistor resistance at 25^{o}C = 5 K ohms

LR = value from Table II, curve F, corresponding to the ratio given for the next lower temperature from the temperature point to be interpolated e. g., if the temperature point is 15^{o}C LR would be the ratio for 10^{o}C.

C = the temperature point given in ^{o}C.

C_L = the next lower temperature increment on Table II e.g., if the temperature point is $15^{o}C$, C_L would be $10^{o}C$

HR = the value from Table II, curve F corresponding to the ratio given for the next higher temperature from the temperature point to be interpolated, e.g., if the temperature point is $15^{o}C$, HR would be the ratio for $20^{o}C$.

Calculations:

R for 45^{o} F ($7.2^{o}C$) = $5\left[3.930 - 0.1\ (7.2-0)\ (3.930-2.159)\right]$
= 13.25 Kohms

R for $130^{o}F$ ($54.5^{o}C$) = $5\left[.3260-0.1\ (54.5-50.)\ (.326-.219)\right]$
= 1.39 Kohms

R for $60^{o}F$ ($15.5^{o}C$) = $5\left[2.159-0.1\ (15.5-10.)\ (2.159-1.275)\right]$
= 8.37 Kohms

R for $120^{o}F$ ($49^{o}C$) = $5\left[.5-0.1\ (49-40)\ (.5-.326)\right]$
= 1.715 Kohms

R for $100^{o}F$ ($38^{o}C$) = $5\left[.789-0.1\ (38 - 30)\ (.789-.5)\right]$
= 2.8 Kohms

R for $90^{o}F$ ($32.3^{o}C$) = $5\left[.789-0.1\ (32.3-30)\ (.789 - .5)\right]$
= 3.65 Kohms

R for $110^{o}F$ ($43.3^{o}C$) = $5\left[.5-0.1\ (43.3-40)\ (.5-.326)\right]$
= 2.21 Kohms

Thermistor resistance ranges calculated from given temperature ranges are then:

	CSM	LEM
CGC/LGC	13.25K to 1.4K	Same
PSA	8.37K to 1.715K	8.37K to 2.21K
PEA/PTA	13.25K to 2.8K	13.25K to 3.65K

A 3 percent tolerance is allowable for measurement of those resistances which correspond to temperature below 100°F.

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