Calibration-Resistance Ratio's

How do you interpret a calibration report listing resistance ratio's and inverse differences?

The resistance ratio is the ratio of the resistance of the thermometer at some temperature (t) to the resistance of the thermometer at the ice point (t0).

Example

If the resistance of a platinum resistance thermometer is 25.51548 ohms at the ice point, what is the temperature when its resistance is 26.53035?

The Resistance ratio (RR) is expressed as:

RR= RT / RO

The resistance ratio is found as follows:

26.53035 / 25.51548

RR= 1.03977467

The table indicates that this ratio corresponds to + 10°C.

SAMPLE PRT TABLE		
Ro = 25.51548 ohms		
Temp	Resistance Ratio	Inverse Difference
0°C	.9999601	
10°C	1.03977467	251.5103

The inverse difference column is provided as an aid to interpolation. The inverse difference listed in the table is the reciprocal of the difference between the resistance ratios at that temperature and the next lower temperature.

If the resistance ratio (RR) does not result in a whole number on the temperature scale, linear interpolation may be used to find the temperature using the following expression: t = t2 +[(RR - RR2) x ID]

Where:

T = the measurement temperature

T2 = the lower of the two temperatures in the table which bracket the resistance ratio computed

RR = the resistance ratio computed in the measurement

RR2 = the resistance ratio at t2

ID = the inverse difference for the temperature which has the resistance ratio which is just greater than RR

Example: The ice point resistance of a thermometer is 25.51548 ohms. The resistance of the thermometer at some temperature is measured as 25.84327 ohms. What is the temperature? The resistance ratio is found as follows:

RR=RT/R0

25.84327 / 25.51548

RR = 1.01284671

The chart indicates this ratio lies between 3°C and 4°C. The inverse difference for 4°C is 251.0493, and the resistance ratio for 3°C is 1.01191728.

Substituting these values into equation yields:

t = t2 +[(RR - RR2) x ID]

t = 3°C+ (1.01284671 - 1.01191728) x 251.0493

3°C + (.00092943) x 251.0493

3°C + .2333327

or: t = 3. 2333327 °C

SAMPLE PRT TABLE		
Ro = 25.51548 ohms		
Temp	Resistance Ratio	Inverse Difference
0°C	.9999601	
1°C	1.00394706	250.8190
2°C	1.00793278	250.8957
3°C	1.01191728	250.9725
4°C	1.01590056	251.0493
5°C	1.01988262	251.1263
6°C	1.02386346	251.2033
7°C	1.02784309	251.2796
8°C	1.03182152	251.3554
9°C	1.03579869	251.4351

If the table is given in 1°C increments, the precision of the mathematical computations for determine the measurement temperatures using linear interpolation is .0001°C. This does not imply that the precision of the Platinum Resistance Thermometer is .0001°C. If the precision of the measuring instrument used to measure the thermometer resistance (Mueller bridge) is compatible to the thermometer, the uncertainty of the system is about 0.01°C.