Sensor Resistance

In support of field troubleshooting flow meters with defective wiring or sensors, the nominal sensor resistance characteristics need to be known.

Table AL-1. Typical Kurz sensors

Sensor Name	Nominal Resistance Rp, velocity RTD (Ω) @ 0 °C	Nominal Resistance Rtc. Ref. Temp RTD (Ω) @ 0 °C	Sting Diameter (inches)	Velocity Sting length (inches)
FD	9	300	0.106	2.13
FD purge	9	300	0.106	3.09
FD2	9	27	0.106	2.13
FD2 purge	9	27	0.106	3.09
MD	9	100	0.071	1.41
CD	20	20	0.040	0.50

The RTD equation

$$R(T) = R0 [1+ (\alpha - \beta T)T]$$

Where
R0 = RTD resistance at 0 °C
T = temperature in ° C
α = 0.003908 (0.00385 platinum sensors)
$\beta = 5.80 \times 10^{-7}$

For temperatures (between -25 and 135 °C with less than 0.2% resistance error, ~ 0.6 % temperature error) you can used the simplified first order equation

$$R(T) = R0 [1+ 0.00385 T].$$

Normalizing the second order equation to R0 = 1 you get the graph in Figure AL-1 and Table AL-2.

Example

RTD measures 45.3 Ω, R0 = 27.15 Ω (read from meter data in Program Mode), loop wire resistance is 0.78 ohm, ambient temperature is 168 °C.

Normalized resistance is (45.3-0.78)/27.15 = 1.64

Looking up in the AL-2 table we have just under 170 °C so this RTD is working properly since the ambient temperature is 168 °C. A more accurate temperature calculation can be made by using interpolation between numbers in the table at 160 and 170 °C.

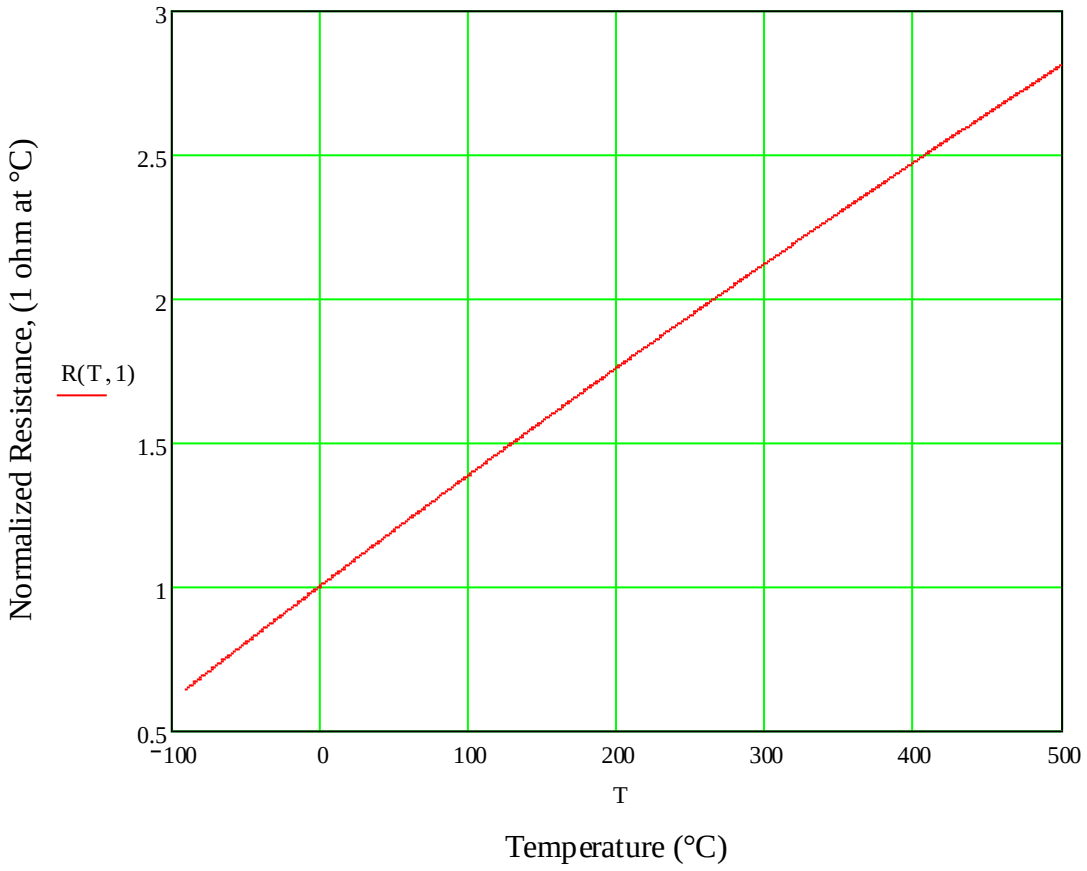

Figure AL-1. Platinum RTD resistance graph, normalized to 1 Ω at 0 °C.

Table AL-2. Platinum RTD resistance graph normalized to 1 ohm at 0 °C

Temp. °C	Resistance Ratio	Temp. °C	Resistance Ratio
-100	0.6034	200	1.7584
-90	0.6436	210	1.7951
-80	0.6836	220	1.8317
-70	0.7236	230	1.8682
-60	0.7634	240	1.9045
-50	0.8032	250	1.9407
-40	0.8428	260	1.9769
-30	0.8822	270	2.0129
-20	0.9216	280	2.0488
-10	0.9609	290	2.0845
0	1	300	2.1202
10	1.039	310	2.1557
20	1.0779	320	2.1912
30	1.1167	330	2.2265
40	1.1554	340	2.2617
50	1.194	350	2.2968
60	1.2324	360	2.3317
70	1.2707	370	2.3666
80	1.3089	380	2.4013
90	1.347	390	2.4359
100	1.385	400	2.4704
110	1.4229	410	2.5048
120	1.4606	420	2.539
130	1.4982	430	2.5732
140	1.5358	440	2.6072
150	1.5732	450	2.6412
160	1.6104	460	2.675
170	1.6476	470	2.7086
180	1.6846	480	2.7422
190	1.7216	490	2.7757
		500	2.809

Table AL-3. Color Code used for sensors

	Shielded Cable Colors	Loose wire Colors
Rtch (high side of ambient RTD)	White/blue	White
Rtcl (low side of ambient RTD)	White	White
Rph (high side of velocity RTD)	White/orange	Yellow
Rpl (low side of velocity RTD)	White/green	Red
Rps (shorted to low side of velocity RTD, wire resistance compensation)	White/red	Red