Detector Tolerance and Accuracy

The two most important factors affecting detector tolerance are deviation from the nominal resistance value at 0 °C and variation in the temperature coefficient (Alpha) of the platinum wire. The first factor, deviation from R0, is a direct result of the manufacturing method and a tolerance of ±0.01 % is achievable. In the case of Alpha variation, the wire manufacturer dictates to a large extent the final values obtained. However, manufacturing processes do cause changes in the metal and it is essential to have complete control of every stage of production in order to guarantee minimum deviation from specification. Detectors supplied by Intempco have close control of manufacturing techniques and critical selection of materials resulting in typical Alpha deviation of less than ±0.000003 °C^{-1} .

This ensures the very highest conformance to the temperature/resistance characteristicts thus giving full confidence in detector interchangeability and allowing critical measurements, such as determination of small temperature differentials, to be made with accuracy, stability and repeatability.

Intempco builds PRT's (Platinum Resistance Thermometer) to meet DIN EN 60751. This standard defines the PRT's temperature coefficient (TC) as :

$$\alpha = [R_{100}-R_0] / [R_0 * 100\,°C]$$

conventially written as :

$$\alpha = 3.851 \times 10^{-3}\ °C^{-1}$$

Where: R_0 = Resistance at 0 °C
R_{100} = Resistance at 100 °C

Standard R_0 values for Intempco PRT's are 100 Ω and 1000 Ω. Other values are available.

Intempco PRT's are available in tolerance classes as defined by DIN EN 60751 and shown in table 1.

Other standards may be available. Table 2 lists some of these standards which are less common today. Consult Intempco engineering support team for specific requirements.

Table 1 : Thermometer Tolerance Classes per DIN EN 60751

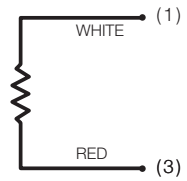
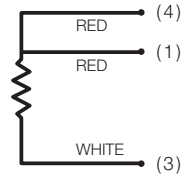
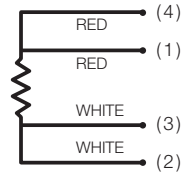
Tolerance Classes	Resistance Tolerance @ 0 °C	Tolerance As a Function of Absolute Value of Temperature in Deg. C
Class AA	±0.04 % (±0.1 °C)	±[0.1 + (0.0017 * |t|)]
Class A	±0.06 % (±0.15 °C)	±[0.15 + (0.002 * |t|)]
Class B	±0.12 % (±0.3 °C)	±[0.3 + (0.005 * |t|)]
Class C	±0.23 % (±0.6 °C)	±[0.6 + (0.01 * |t|)]

Table 2 : Standard for RTD's

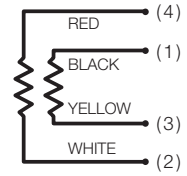
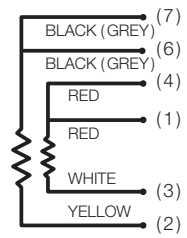
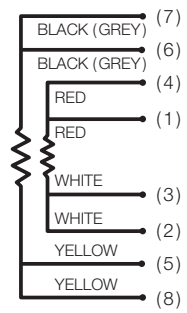
Organization	Standard	ALPHA : Average Temperature Coefficient of Resistance (0 °C)$^{-1}$	Nominal Resistance at 0 °C
British Standard	BS 1904 : 1984	0.003850	100
Deutshen Institut fur Normung	DIN 43760 : 1980	0.003850	100
International Electrotechnical Commission	IEC 751 : 1995 (Amend. 2)	0.00385055	100
Scientific Apparatus Manufacturers of America	SAMA RC-4-1966	0.003923	98.129
Japanese Standard	JIS C1604-1981	0.003916	100
American Society for Testing & Materials	ASTM E1137	0.00385055	100

Element Wiring Ordering Code

Single Element Lead Configuration

	**CODE** **S2**	Lead configuration S2 provides one connection to each end of the sensor. This construction is suitable where the resistance of the run of lead wire may be considered as an additive constant in the circuit, and particularly where the changes in lead resistance due to ambient temperature changes may be ignored.
	**CODE** **S3**	Lead configuration S3 provides two connections on one side of the sensor and one to the other side of the sensor. This construction is used for measurments of the highest precision and should be prefered to S2 for high accuracy measurment.
	**CODE** **S4**	Lead configuration S4 provides two connections to each end of the sensor. This construction is used for measurments of the highest precision and should be prefered to S3 for high accuracy measurment.

Dual Element Lead Configuration

	**CODE** **D2**	Lead configuration D2 is similar to Lead configuration S2. Two element construction provides 2 seperate signals for instrumentation purposes or as back-up.
	**CODE** **D3**	Lead configuration D3 is similar to Lead configuration S3. Two element construction provides 2 seperate signals for instrumentation purposes or as back-up.
	**CODE** **D4**	Lead configuration D4 is similar to Lead configuration S4. Two element construction provides 2 seperate signals for instrumentation purposes or as back-up.

Element Ordering Code

CODE	Element Type
P	100 Ω @ 0°C, α = 0.00385 DIN EN 60751
R	100 Ω @ 0°C, α = .003916 JEMIMA (JIS)
T	1000 Ω @ 0°C, α = 0.00385 DIN EN 60751
U	1000 Ω @ 0°C, α = 0.00375

BOX3 CODE	Element Tolerance
1	±0.12 % (±0.3°C) @ 0°C, Class B
2	±0.06 % (±0.15°C) @ 0°C, Class A
3	±0.04 % (±0.1°C) @ 0°C, Class AA
4	±0.23 % (±0.6°C) @ 0°C, Class C

Material Description

316 Stainless Steel : *(6% Chromium-10% Nickel)* is a material that has improved resistance to corrosion as compared to 304 SS or 310 SS with improved oxidation resistance and a higher hot strength than 304 SS. Maximum operating temperature 926 °C (1700 °F).

Inconel 600 : *(72% Nickel-17% Chromium)* is a material that is readily available and has outstanding resistance to oxidation, corrosion and scaling. Should not be used in the presence of sulfur above 1600°F. Maximum operating temperature 1204 °C (2200 °F).

Monel 400 : *(67% Nickel-30% Copper)* is highly resistant to atmospheric action, seawater, steam, foodstuffs, and many industrial chemicals. It deteriorates rapidly in presence of moist chlorine and ferric, stannic, or mercuric salts in acid solutions. It must not be exposed when hot to molten metals, sulfur or gaseous products of combustion containing sulfur. Maximum operating temperature 982 °C (1800 °F).

Hastelloy C : *(51% Nickel-19% Molybdenum-17% Chromium)* is exceptionally resistant to corrosion by hot concentrated acids such as hydrochloric, sulfuric, and nitric. Hastelloy C has good strength at elevated temperature.

RTD's

Temperature vs Resistance Table, -200 °C to 800 °C

$R_0 = 100\,\Omega$, $\alpha = 0.00385$, DIN EN 60751

For other R_0 values, multiply resistance value in table by $R_0/100$

°C	Ω
-200	**18.52**
-199	18.95
-198	19.38
-197	19.82
-196	20.25
-195	20.68
-194	21.11
-193	21.54
-192	21.97
-191	22.40
-190	22.83
-189	23.25
-188	23.68
-187	24.11
-186	24.54
-185	24.97
-184	25.39
-183	25.82
-182	26.24
-181	26.67
-180	27.10
-179	27.52
-178	27.95
-177	28.37
-176	28.80
-175	29.22
-174	29.64
-173	30.07
-172	30.49
-171	30.91
-170	31.34
-169	31.76
-168	32.18
-167	32.60
-166	33.02
-165	33.44
-164	33.86
-163	34.28
-162	34.70
-161	35.12
-160	35.54
-159	35.96
-158	36.38
-157	36.80
-156	37.22
-155	37.64
-154	38.05
-153	38.47
-152	38.89
-151	39.31
-150	**39.72**
-149	40.14
-148	40.56
-147	40.97
-146	41.39
-145	41.80
-144	42.22
-143	42.63
-142	43.05
-141	43.46
-140	43.88
-139	44.29
-138	44.70
-137	45.12
-136	45.53
-135	45.94
-134	46.36
-133	46.77
-132	47.18
-131	47.59
-130	48.00
-129	48.42
-128	48.83
-127	49.24
-126	49.65
-125	50.06
-124	50.47
-123	50.88
-122	51.29
-121	51.70
-120	52.11
-119	52.52
-118	52.93
-117	53.34
-116	53.75
-115	54.15
-114	54.56
-113	54.97
-112	55.38
-111	55.79
-110	56.19
-109	56.60
-107	57.01
-106	57.41
-105	57.82
-104	58.23
-103	58.63
-102	59.04
-101	59.44
-100	**59.85**
-99	60.26
-98	60.66
-97	61.07
-96	61.47
-95	61.88
-94	62.28
-93	62.68
-92	63.09
-91	63.49
-90	63.90
-89	64.30
-88	64.70
-87	65.11
-86	65.51
-85	65.91
-84	66.31
-83	66.72
-82	67.12
-81	67.52
-80	67.92
-79	68.33
-78	68.73
-77	69.13
-76	69.53
-75	69.93
-74	70.33
-73	70.73
-72	71.13
-71	71.53
-70	71.93
-69	72.33
-68	72.73
-67	73.13
-66	73.53
-65	73.93
-64	74.33
-63	74.73
-62	75.13
-61	75.53
-60	75.93
-59	76.33
-58	76.73
-57	77.12
	77.52
-56	77.92
-55	78.32
-54	78.72
-53	79.11
-52	79.51
-51	79.91
-50	**80.31**
-49	80.70
-48	81.10
-47	81.50
-46	81.89
-45	82.29
-44	82.69
-43	83.08
-42	83.48
-41	83.87
-40	84.27
-39	84.67
-38	85.06
-37	85.46
-36	85.85
-35	86.25
-34	86.64
-33	87.04
-32	87.43
-31	87.83
-30	88.22
-29	88.62
-28	89.01
-27	89.40
-26	89.80
-25	90.19
-24	90.59
-23	90.98
-22	91.37
-21	91.77
-20	92.16
-19	92.55
-18	92.95
-17	93.34
-16	93.73
-15	94.12
-14	94.52
-13	94.91
-12	95.30
-11	95.69
-10	96.09
-9	96.48
-8	96.87
-7	97.26
-6	97.65
-5	98.04
-4	98.44
-3	98.83
-2	99.22
-1	99.61
0	**100.00**
1	100.39
2	100.78
3	101.17
4	101.56
5	101.95
6	102.34
7	102.73
8	103.12
9	103.51
10	103.90
11	104.29
12	104.68
13	105.07
14	105.46
15	105.85
16	106.24
17	106.63
18	107.02
19	107.40
20	107.79
21	108.18
22	108.57
23	108.96
24	109.35
25	109.73
26	110.12
27	110.51
28	110.90
29	111.29
30	111.67
31	112.06
32	112.45
33	112.83
34	113.22
35	113.61
36	114.00
37	114.38
38	114.77
39	115.15
40	115.54
41	115.93
42	116.31
43	116.70
44	117.08
45	117.47
46	117.86
47	118.24
48	118.63
49	119.01
50	**119.40**
51	119.78
52	120.17
53	120.55
54	120.94
55	121.32
56	121.71
57	122.09
58	122.47
59	122.86
60	123.24
61	123.63
62	124.01
63	124.39
64	124.78
65	125.16
66	125.54
67	125.93
68	126.31
69	126.69
70	127.08
71	127.46
72	127.84
73	128.22
74	128.61
75	128.99
76	129.37
77	129.75
78	130.13
79	130.52
80	130.90
81	131.28
82	131.66
83	132.04
84	132.42
85	132.80
86	133.18
87	133.57
88	133.95
89	134.33
90	134.71
91	135.09
92	135.47
93	135.85
94	136.23
95	136.61
96	136.99
97	137.37
98	137.75
99	138.13
100	**138.51**
101	138.88
102	139.26
103	139.64
104	140.02
105	140.40
106	140.78
107	141.16
108	141.54
109	141.91
110	142.29
111	142.67
112	143.05
113	143.43
114	143.80
115	144.18
116	144.56
117	144.94
118	145.31
119	145.69
120	146.07
121	146.44
122	146.82
123	147.20
124	147.57
125	147.95
126	148.33
127	148.70
128	149.08
129	149.46
130	149.83
131	150.21
132	150.58
133	150.96
134	151.33
135	151.71
136	152.08
137	152.46
138	152.83
139	153.21
140	153.58
141	153.96
142	154.33
143	154.71
144	155.08
145	155.46
146	155.83
147	156.20
148	156.58
149	156.95
150	**157.33**
151	157.70
152	158.07
153	158.45
154	158.82
155	159.19
156	159.56
157	159.94
158	160.31
159	160.68
160	161.05
161	161.43
162	161.80
163	162.17
164	162.54
165	162.91
166	163.29
167	163.66
168	164.03
169	164.40
170	164.77
171	165.14
172	165.51
173	165.89
174	166.26
175	166.63
176	167.00
177	167.37
178	167.74
179	168.11
180	168.48
181	168.85
182	169.22
183	169.59
184	169.96
185	170.33
186	170.70
187	171.07
188	171.43
189	171.80
190	172.17
191	172.54
192	172.91
193	173.28
194	173.65
195	174.02
196	174.38
197	174.75
198	175.12
199	175.49
200	**175.86**
201	176.22
202	176.59
203	176.96
204	177.33
205	177.69
206	178.06
207	178.43
208	178.79
209	179.16
210	179.53
211	179.89
212	180.26
213	180.63
214	180.99
215	181.36
216	181.72
217	182.09
218	182.46
219	182.82
220	183.19
221	183.55
222	183.92
223	184.28
224	184.65
225	185.01
226	185.38
227	185.74
228	186.11
229	186.47
230	186.84
231	187.20
232	187.56
233	187.93
234	188.29
235	188.66
236	189.02
237	189.38
238	189.75
239	190.11
240	190.47
241	190.84
242	191.20
243	191.56
244	191.92
245	192.29
246	192.65
247	193.01
248	193.37
249	193.74
250	**194.10**
251	194.46
252	194.82
253	195.18
254	195.55
255	195.91
256	196.27
257	196.63
258	196.99
259	197.35
260	197.71
261	198.07
262	198.43
263	198.79
264	199.15
265	199.51
266	199.87
267	200.23
268	200.59
269	200.95
270	201.31
271	201.67
272	202.03
273	202.39
274	202.75
275	203.11
276	203.47
277	203.83
278	204.19
279	204.55
280	204.90
281	205.26
282	205.62
283	205.98
284	206.34
285	206.70
286	207.05
287	207.41
288	207.77
289	208.13
290	208.48
291	208.84
292	209.20
293	209.56
294	209.91
295	210.27
296	210.63
297	210.98
298	211.34
299	211.70
300	**212.05**

RTD's

Temperature vs Resistance Table, -200 °C to 800 °C

$R_0 = 100\,\Omega$, $\alpha = 0.00385$, DIN EN 60751

For other R_0 values, multiply resistance value in table by $R_0/100$

°C	Ω
300	**212.05**
301	212.41
302	212.76
303	213.12
304	213.48
305	213.83
306	214.19
307	214.54
308	214.90
309	215.25
310	215.61
311	215.96
312	216.32
313	216.67
314	217.03
315	217.38
316	217.74
317	218.09
318	218.44
319	218.80
320	219.15
321	219.51
322	219.86
323	220.21
324	220.57
325	220.92
326	221.27
327	221.63
328	221.98
329	222.33
330	222.68
331	223.04
332	223.39
333	223.74
334	224.09
335	224.45
336	224.80
337	225.15
338	225.50
339	225.85
340	226.21
341	226.56
342	226.91
343	227.26
344	227.61
345	227.96
346	228.31
347	228.66
348	229.02
349	229.37
350	**229.72**
351	230.07
352	230.42
353	230.77
354	231.12
355	231.47
356	231.82
357	232.17
358	232.52
359	232.87
360	233.21
361	233.56
362	233.91
363	234.26
364	234.61
365	234.96
366	235.31
367	235.66
368	236.00
369	236.35
370	236.70
371	237.05
372	237.40
373	237.74
374	238.09
375	238.44
376	238.79
377	239.13
378	239.48
379	239.83
380	240.18
381	240.52
382	240.87
383	241.22
384	241.56
385	241.91
386	242.26
387	242.60
388	242.95
389	243.29
390	243.64
391	243.99
392	244.33
393	244.68
394	245.02
395	245.37
396	245.71
397	246.06
398	246.40
399	246.75
400	**247.09**
401	247.44
402	247.78
403	248.13
404	248.47
405	248.81
406	249.16
407	249.50
408	249.85
409	250.19
410	250.53
411	250.88
412	251.22
413	251.56
414	251.91
415	252.25
416	252.59
417	252.93
418	253.28
419	253.62
420	253.96
421	254.30
422	254.65
423	254.99
424	255.33
425	255.67
426	256.01
427	256.35
428	256.70
429	257.04
430	257.38
431	257.72
432	258.06
433	258.40
434	258.74
435	259.08
436	259.42
437	259.76
438	260.10
439	260.44
440	260.78
441	261.12
442	261.46
443	261.80
444	262.14
445	262.48
446	262.82
447	263.16
448	263.50
449	263.84
450	**264.18**
451	264.52
452	264.86
453	265.20
454	265.53
455	265.87
456	266.21
457	266.55
458	266.89
459	267.22
460	267.56
461	267.90
462	268.24
463	268.57
464	268.91
465	269.25
466	269.59
467	269.92
468	270.26
469	270.60
470	270.93
471	271.27
472	271.61
473	271.94
474	272.28
475	272.61
476	272.95
477	273.29
478	273.62
479	273.96
480	274.29
481	274.63
482	274.96
483	275.30
484	275.63
485	275.97
486	276.30
487	276.64
488	276.97
489	277.31
490	277.64
491	277.98
492	278.31
493	278.64
494	278.98
495	279.31
496	279.64
497	279.98
498	280.31
499	280.64
500	**280.98**
501	281.31
502	281.64
503	281.98
504	282.31
505	282.64
506	282.97
507	283.31
508	283.64
509	283.97
510	284.30
511	284.63
512	284.97
513	285.30
514	285.63
515	285.96
516	286.29
517	286.62
518	286.95
519	287.29
520	287.62
521	287.95
522	288.28
523	288.61
524	288.94
525	289.27
526	289.60
527	289.93
528	290.26
529	290.59
530	290.92
531	291.25
532	291.58
533	291.91
534	292.24
535	292.56
536	292.89
537	293.22
538	293.55
539	293.88
540	294.21
541	294.54
542	294.86
543	295.19
544	295.52
545	295.85
546	296.18
547	296.50
548	296.83
549	297.16
550	**297.49**
551	297.81
552	298.14
553	298.47
554	298.80
555	299.12
556	299.45
557	299.78
558	300.10
559	300.43
560	300.75
561	301.08
562	301.41
563	301.73
564	302.06
565	302.38
566	302.71
567	303.03
568	303.36
569	303.69
570	304.01
571	304.34
572	304.66
573	304.98
574	305.31
575	305.63
576	305.96
577	306.28
578	306.61
579	306.93
580	307.25
581	307.58
582	307.90
583	308.23
584	308.55
585	308.87
586	309.20
587	309.52
588	309.84
589	310.16
590	310.49
591	310.81
592	311.13
593	311.45
594	311.78
595	312.10
596	312.42
597	312.74
598	313.06
599	313.39
600	**313.71**
601	314.03
602	314.35
603	314.67
604	314.99
605	315.31
606	315.64
607	315.96
608	316.28
609	316.60
610	316.92
611	317.24
612	317.56
613	317.88
614	318.20
615	318.52
616	318.84
617	319.16
618	319.48
619	319.80
620	320.12
621	320.43
622	320.75
623	321.07
624	321.39
625	321.71
626	322.03
627	322.35
628	322.67
629	322.98
630	323.30
631	323.62
632	323.94
633	324.26
634	324.57
635	324.89
636	325.21
637	325.53
638	325.84
639	326.16
640	326.48
641	326.79
642	327.11
643	327.43
644	327.74
645	328.06
646	328.38
647	328.69
648	329.01
649	329.32
650	**329.64**
651	329.96
652	330.27
653	330.59
654	330.90
655	331.22
656	331.53
657	331.85
658	332.16
659	332.48
660	332.79
661	333.11
662	333.42
663	333.74
664	334.05
665	334.36
666	334.68
667	334.99
668	335.31
669	335.62
670	335.93
671	336.25
672	336.56
673	336.87
674	337.18
675	337.50
676	337.81
677	338.12
678	338.44
679	338.75
680	339.06
681	339.37
682	339.69
683	340.00
684	340.31
685	340.62
686	340.93
687	341.24
688	341.56
689	341.87
690	342.18
691	342.49
692	342.80
693	343.11
694	343.42
695	343.73
696	344.04
697	344.35
698	344.66
699	344.97
700	**345.28**
701	345.59
702	345.90
703	346.21
704	346.52
705	346.83
706	347.14
707	347.45
708	347.76
709	348.07
710	348.38
711	348.69
712	348.99
713	349.30
714	349.61
715	349.92
716	350.23
717	350.54
718	350.84
719	351.15
720	351.46
721	351.77
722	352.08
723	352.38
724	352.69
725	353.00
726	353.30
727	353.61
728	353.92
729	354.22
730	354.53
731	354.84
732	355.14
733	355.45
734	355.76
735	356.06
736	356.37
737	356.67
738	356.98
739	357.28
740	357.59
741	357.90
742	358.20
743	358.51
744	358.81
745	359.12
746	359.42
747	359.72
748	360.03
749	360.33
750	**360.64**
751	360.94
752	361.25
753	361.55
754	361.85
755	362.16
756	362.46
757	362.76
758	363.07
759	363.37
760	363.67
761	363.98
762	364.28
763	364.58
764	364.89
765	365.19
766	365.49
767	365.79
768	366.10
769	366.40
770	366.70
771	367.00
772	367.30
773	367.60
774	367.91
775	368.21
776	368.51
777	368.81
778	369.11
779	369.41
780	369.71
781	370.01
782	370.31
783	370.61
784	370.91
785	371.21
786	371.51
787	371.81
788	372.11
789	372.41
790	372.71
791	373.01
792	373.31
793	373.61
794	373.91
795	374.21
796	374.51
797	374.81
798	375.11
799	375.41
800	**375.70**