

Temperature sensing elements Pt 1000, $\alpha = 3.851 \cdot 10^{-3} \text{ }^{\circ}\text{C}^{-1}$

Basic technical parameters

Sensing element	Thin-film platinum resistor
Maximum range of working temperature	-200 to 800 $^{\circ}\text{C}$ ¹⁾
Resistance at 0 $^{\circ}\text{C}$	1000 Ω
Long-term resistance stability	0.03 % after 1000 h at $t = 400 \text{ }^{\circ}\text{C}$
Recommended / maximum direct measuring current	Class A: 0.2 mA / 0.5 mA ²⁾ Class B: 0.3 mA / 0.8 mA ²⁾

1) The real range of working temperature of the sensor is given by the design and technology.

2) Applies to a temperature range of -50 to +400 $^{\circ}\text{C}$

The temperature dependence of the sensing element resistance is expressed as follows:

$$R = 1000 (1 + At + Bt^2 + C(t-100)t^3) \quad \text{in a temperature range of } -200 \text{ to } 0 \text{ }^{\circ}\text{C}$$

$$R = 1000 (1 + At + Bt^2) \quad \text{in a temperature range of } 0 \text{ to } 850 \text{ }^{\circ}\text{C}$$

850 $^{\circ}\text{C}$

where: $A = 3.9083 \cdot 10^{-3} \text{ }^{\circ}\text{C}^{-1}$ $B = -5.775 \cdot 10^{-7} \text{ }^{\circ}\text{C}^{-2}$ $C = -4.183 \cdot 10^{-12} \text{ }^{\circ}\text{C}^{-4}$

Dependence of resistance on temperature in ohms [Ω]:

$^{\circ}\text{C}$	0	-1	-2	-3	-4	-5	-6	-7	-8	-9
-200	185.20									
-190	228.25	223.97	219.67	215.38	211.08	206.77	202.47	198.15	193.84	189.52
-180	270.96	266.71	262.45	258.19	253.92	249.65	245.38	241.10	236.82	232.54
-170	313.35	309.13	304.90	300.67	296.43	292.20	287.96	283.71	279.47	275.22
-160	355.43	351.24	347.04	342.84	338.64	334.43	330.22	326.01	321.79	317.57
-150	397.23	393.06	388.89	384.72	380.55	376.37	372.19	368.00	363.82	359.63
-140	438.76	434.62	430.48	426.33	422.18	418.03	413.88	409.72	405.56	401.40
-130	480.05	475.93	471.81	467.69	463.56	459.44	455.31	451.17	447.04	442.90
-120	521.10	517.00	512.91	508.81	504.70	500.60	496.49	492.39	488.28	484.16
-110	561.93	557.86	553.78	549.70	545.62	541.54	537.46	533.37	529.28	525.19
-100	602.56	598.50	594.45	590.39	586.33	582.27	578.21	574.14	570.07	566.00
-90	643.00	638.96	634.92	630.88	626.84	622.80	618.76	614.71	610.66	606.61
-80	683.25	679.24	675.22	671.19	667.17	663.15	659.12	655.09	651.06	647.03
-70	723.35	719.34	715.34	711.34	707.33	703.32	699.31	695.30	691.29	687.27
-60	763.28	759.29	755.30	751.31	747.32	743.33	739.33	735.34	731.34	727.35
-50	803.06	799.09	795.12	791.14	787.17	783.19	779.21	775.23	771.25	767.26
-40	842.71	838.75	834.79	830.83	826.87	822.90	818.94	814.97	811.00	807.03
-30	882.22	878.27	874.32	870.38	866.43	862.48	858.53	854.57	850.62	846.66
-20	921.60	917.67	913.73	909.80	905.86	901.92	897.98	894.04	890.10	886.16
-10	960.86	956.94	953.02	949.09	945.17	941.24	937.32	933.39	929.46	925.53
0	1000.00	996.09	992.18	988.27	984.36	980.44	976.53	972.61	968.70	964.78

$^{\circ}\text{C}$	0	1	2	3	4	5	6	7	8	9
0	1000.00	1003.91	1007.81	1011.72	1015.62	1019.53	1023.43	1027.33	1031.23	1035.13
10	1039.03	1042.92	1046.82	1050.71	1054.60	1058.49	1062.38	1066.27	1070.16	1074.05
20	1077.94	1081.82	1085.70	1089.59	1093.47	1097.35	1101.23	1105.10	1108.98	1112.86
30	1116.73	1120.60	1124.47	1128.35	1132.21	1136.08	1139.95	1143.82	1147.68	1151.55
40	1155.41	1159.27	1163.13	1166.99	1170.85	1174.70	1178.56	1182.41	1186.27	1190.12
50	1193.97	1197.82	1201.67	1205.52	1209.36	1213.21	1217.05	1220.90	1224.74	1228.58
60	1232.42	1236.26	1240.09	1243.93	1247.77	1251.60	1255.43	1259.26	1263.09	1266.92
70	1270.75	1274.58	1278.40	1282.23	1286.05	1289.87	1293.70	1297.52	1301.33	1305.15
80	1308.97	1312.78	1316.60	1320.41	1324.22	1328.03	1331.84	1335.65	1339.46	1343.26
90	1347.07	1350.87	1354.68	1358.48	1362.28	1366.08	1369.87	1373.67	1377.47	1381.26
100	1385.06	1388.85	1392.64	1396.43	1400.22	1404.00	1407.79	1411.58	1415.36	1419.14

110	1422.93	1426.71	1430.49	1434.26	1438.04	1441.82	1445.59	1449.37	1453.14	1456.91
120	1460.68	1464.45	1468.22	1471.98	1475.75	1479.51	1483.28	1487.04	1490.80	1494.56
130	1498.32	1502.08	1505.83	1509.59	1513.34	1517.10	1520.85	1524.60	1528.35	1532.10
140	1535.84	1539.59	1543.33	1547.08	1550.82	1554.56	1558.30	1562.04	1565.78	1569.52
150	1573.25	1576.99	1580.72	1584.45	1588.18	1591.91	1595.64	1599.37	1603.09	1606.82
160	1610.54	1614.27	1617.99	1621.71	1625.43	1629.15	1632.86	1636.58	1640.30	1644.01
170	1647.72	1651.43	1655.14	1658.85	1662.56	1666.27	1669.97	1673.68	1677.38	1681.08
180	1684.78	1688.48	1692.18	1695.88	1699.58	1703.27	1706.96	1710.66	1714.35	1718.04
190	1721.73	1725.42	1729.10	1732.79	1736.48	1740.16	1743.84	1747.52	1751.20	1754.88
200	1758.56	1762.24	1765.91	1769.59	1773.26	1776.93	1780.60	1784.27	1787.94	1791.61
210	1795.28	1798.94	1802.60	1806.27	1809.93	1813.59	1817.25	1820.91	1824.56	1828.22
220	1831.88	1835.53	1839.18	1842.83	1846.48	1850.13	1853.78	1857.43	1861.07	1864.72
230	1868.36	1872.00	1875.64	1879.28	1882.92	1886.56	1890.19	1893.83	1897.46	1901.10
240	1904.73	1908.36	1911.99	1915.62	1919.24	1922.87	1926.49	1930.12	1933.74	1937.36
250	1940.98	1944.60	1948.22	1951.83	1955.45	1959.06	1962.68	1966.29	1969.90	1973.51
260	1977.12	1980.73	1984.33	1987.94	1991.54	1995.14	1998.75	2002.35	2005.95	2009.54
270	2013.14	2016.74	2020.33	2023.93	2027.52	2031.11	2034.70	2038.29	2041.88	2045.46
280	2049.05	2052.63	2056.22	2059.80	2063.38	2066.96	2070.54	2074.11	2077.69	2081.27
290	2084.84	2088.41	2091.98	2095.55	2099.12	2102.69	2106.26	2109.82	2113.39	2116.95
300	2120.52	2124.08	2127.64	2131.20	2134.75	2138.31	2141.87	2145.42	2148.97	2152.52
310	2156.08	2159.62	2163.17	2166.72	2170.27	2173.81	2177.36	2180.90	2184.44	2187.98
320	2191.52	2195.06	2198.60	2202.13	2205.67	2209.20	2212.73	2216.26	2219.79	2223.32
330	2226.85	2230.38	2233.90	2237.43	2240.95	2244.47	2247.99	2251.51	2255.03	2258.55
340	2262.06	2265.58	2269.09	2272.60	2276.12	2279.63	2283.14	2286.64	2290.15	2293.66
350	2297.16	2300.66	2304.17	2307.67	2311.17	2314.67	2318.16	2321.66	2325.16	2328.65
360	2332.14	2335.64	2339.13	2342.62	2346.10	2349.59	2353.08	2356.56	2360.05	2363.53
370	2367.01	2370.49	2373.97	2377.45	2380.93	2384.40	2387.88	2391.35	2394.82	2398.29
380	2401.76	2405.23	2408.70	2412.17	2415.63	2419.10	2422.56	2426.02	2429.48	2432.94
390	2436.40	2439.86	2443.31	2446.77	2450.22	2453.67	2457.13	2460.58	2464.03	2467.47
400	2470.92	2474.37	2477.81	2481.25	2484.70	2488.14	2491.58	2495.02	2498.45	2501.89
410	2505.33	2508.76	2512.19	2515.62	2519.06	2522.48	2525.91	2529.34	2532.77	2536.19
420	2539.62	2543.04	2546.46	2549.88	2553.30	2556.72	2560.13	2563.55	2566.96	2570.38
430	2573.79	2577.20	2580.61	2584.02	2587.43	2590.83	2594.24	2597.64	2601.05	2604.45
440	2607.85	2611.25	2614.65	2618.04	2621.44	2624.83	2628.23	2631.62	2635.01	2638.40
450	2641.79	2645.18	2648.57	2651.95	2655.34	2658.72	2662.10	2665.48	2668.86	2672.24
460	2675.62	2679.00	2682.37	2685.74	2689.12	2692.49	2695.86	2699.23	2702.60	2705.97
470	2709.33	2712.70	2716.06	2719.42	2722.78	2726.14	2729.50	2732.86	2736.22	2739.57
480	2742.93	2746.28	2749.63	2752.98	2756.33	2759.68	2763.03	2766.38	2769.72	2773.07
490	2776.41	2779.75	2783.09	2786.43	2789.77	2793.11	2796.44	2799.78	2803.11	2806.44
500	2809.78	2813.11	2816.43	2819.76	2823.09	2826.41	2829.74	2833.06	2836.38	2839.71
510	2843.03	2846.34	2849.66	2852.98	2856.29	2859.61	2862.92	2866.23	2869.54	2872.85
520	2876.16	2879.47	2882.77	2886.08	2889.38	2892.68	2895.99	2899.29	2902.58	2905.88
530	2909.18	2912.47	2915.77	2919.06	2922.35	2925.65	2928.94	2932.22	2935.51	2938.80
540	2942.08	2945.37	2948.65	2951.93	2955.21	2958.49	2961.77	2965.05	2968.32	2971.60
550	2974.87	2978.14	2981.42	2984.69	2987.95	2991.22	2994.49	2997.75	3001.02	3004.28
560	3007.54	3010.80	3014.06	3017.32	3020.58	3023.84	3027.09	3030.35	3033.60	3036.85
570	3040.10	3043.35	3046.60	3049.85	3053.09	3056.34	3059.58	3062.82	3066.06	3069.30
580	3072.54	3075.78	3079.02	3082.25	3085.49	3088.72	3091.95	3095.18	3098.41	3101.64
590	3104.87	3108.10	3111.32	3114.54	3117.77	3120.99	3124.21	3127.43	3130.65	3133.86
600	3137.08	3140.29	3143.51	3146.72	3149.93	3153.14	3156.35	3159.56	3162.77	3165.97
610	3169.18	3172.38	3175.58	3178.78	3181.98	3186.18	3188.38	3191.57	3194.77	3197.96
620	3201.15	3204.35	3207.54	3210.73	3213.91	3217.10	3220.29	3223.47	3226.66	3229.84
630	3233.02	3236.20	3239.38	3242.56	3245.73	3248.91	3252.08	3255.26	3258.43	3261.60
640	3264.77	3267.94	3271.10	3274.27	3277.44	3280.60	3283.76	3286.92	3290.08	3293.24
650	3296.40	3299.56	3302.71	3305.87	3309.02	3312.17	3315.33	3318.48	3321.62	3324.77
660	3327.92	3331.06	3334.21	3337.35	3340.49	3343.63	3346.77	3349.91	3353.05	3356.19
670	3359.32	3362.46	3365.59	3368.72	3371.85	3374.98	3378.11	3381.23	3384.36	3387.48

680	3390.61	3393.73	3396.85	3399.97	3403.09	3406.21	3409.32	3412.44	3415.55	3418.67
690	3421.78	3424.89	3428.00	3431.11	3434.22	3437.32	3440.43	3443.53	3446.63	3449.73
700	3452.83	3455.93	3459.03	3462.13	3465.22	3468.32	3471.41	3474.51	3477.60	3480.69
710	3483.78	3486.86	3489.95	3493.03	3496.12	3499.20	3502.28	3505.36	3508.44	3511.52
720	3514.60	3517.68	3520.75	3523.82	3526.90	3529.97	3533.04	3536.11	3539.18	3542.24
730	3545.31	3548.37	3551.44	3554.50	3557.56	3560.62	3563.68	3566.74	3569.79	3572.85
740	3575.90	3578.96	3582.01	3585.06	3588.11	3591.16	3594.20	3597.25	3600.29	3603.34
750	3606.38	3609.42	3612.46	3615.50	3618.54	3621.58	3624.61	3627.65	3630.68	3633.71
760	3636.74	3639.77	3642.80	3645.83	3648.86	3651.88	3654.91	3657.93	3660.95	3663.97
770	3666.99	3670.01	3673.03	3676.04	3679.06	3682.07	3685.08	3688.10	3691.11	3694.11
780	3697.12	3700.13	3703.14	3706.14	3709.14	3712.15	3715.15	3718.15	3721.15	3724.14
790	3727.14	3730.13	3733.13	3736.12	3739.11	3742.10	3745.09	3748.08	3751.07	3754.06
800	3757.04									

Sensing element accuracy classes

Temperature [°C]	Resistance [Ω]	Class AA		Class A		Class B		Class C	
		ΔT [°C]	ΔR [Ω]	ΔT [°C]	ΔR [Ω]	ΔT [°C]	ΔR [Ω]	ΔT [°C]	ΔR [Ω]
-50	803.06	-	-	-	-	± 0.55	± 2.18	± 1.10	± 4.36
-30	882.22	-	-	± 0.21	± 0.83	± 0.45	± 1.77	± 0.90	± 3.55
0	1000.00	± 0.10	± 0.39	± 0.15	± 0.59	± 0.30	± 1.17	± 0.60	± 2.34
25	1097.35	± 0.14	± 0.55	± 0.20	± 0.78	± 0.43	± 1.65	± 0.85	± 3.30
100	1385.06	± 0.27	± 1.02	± 0.35	± 1.33	± 0.80	± 3.03	± 1.60	± 6.07
150	1573.25	± 0.36	± 1.33	± 0.45	± 1.68	± 1.05	± 3.92	± 2.10	± 7.84
200	1758.56	-	-	± 0.55	± 2.02	± 1.30	± 4.78	± 2.60	± 9.56
300	2120.52	-	-	± 0.75	± 2.67	± 1.80	± 6.41	± 3.60	± 12.82
400	2470.92	-	-	-	-	± 2.30	± 7.93	± 4.60	± 15.85
500	2809.78	-	-	-	-	± 2.80	± 9.33	± 5.60	± 18.65
600	3137.08	-	-	-	-	-	-	± 6.60	± 21.22

Note: According to EN 60 751, the above relationships only apply to temperature intervals given in the table.

Application of sensing elements:

 Heating industry	 Heating systems	 Air-conditioning	 Alt. energy	 Rail vehicles	 Rubber industry	 Healthcare	 Gastronomy	 Engineering	 Custom manufacturing
 Chemical industry	 Science and research								