

Type K thermocouple sensors

Basic technical parameters

Sensing element	Type K thermocouple
Maximum range of working temperature	-200 to 1200 °C *
Reference voltage at 0 °C	0.00 µV

* The real range of working temperature of the sensor is given by the design and technology

Principle:

A change of the temperature of the measured environment results in a defined change of the measuring thermocouple voltage. The change of voltage is defined by the following equation according to EN 60584-1:

$$U = \sum_{i=1}^n a_i (t_{90})^i \quad \mu\text{V} \quad \text{in a temperature range of } -270 \text{ to } 0 \text{ } ^\circ\text{C}$$

where

$a_1 = 3.945\,012\,8025 \times 10^1$	$a_6 = -5.741\,032\,7428 \times 10^{-10}$
$a_2 = 2.362\,237\,3598 \times 10^{-2}$	$a_7 = -3.108\,887\,2894 \times 10^{-12}$
$a_3 = -3.285\,890\,6784 \times 10^{-4}$	$a_8 = -1.045\,160\,9365 \times 10^{-14}$
$a_4 = -4.990\,482\,8777 \times 10^{-6}$	$a_9 = -1.988\,926\,6878 \times 10^{-17}$
$a_5 = -6.750\,905\,9173 \times 10^{-8}$	$a_{10} = -1.632\,269\,7486 \times 10^{-20}$

$$U = b_0 + \sum_{i=1}^n b_i (t_{90})^i + c_0 \exp[c_1(t_{90} - 126,9686)^2] \quad \mu\text{V} \quad \text{in a temperature range of } 0 \text{ to } 1372 \text{ } ^\circ\text{C}$$

where

$b_0 = -1.760\,041\,3686 \times 10^1$	$b_6 = -3.108\,887\,2894 \times 10^{-12}$
$b_1 = 3.892\,120\,4975 \times 10^1$	$b_7 = -1.045\,160\,9365 \times 10^{-14}$
$b_2 = 1.855\,877\,0032 \times 10^{-2}$	$b_8 = -1.988\,926\,6878 \times 10^{-17}$
$b_3 = -9.945\,759\,2874 \times 10^{-5}$	$b_9 = -1.632\,269\,7486 \times 10^{-20}$
$b_4 = 3.184\,094\,5719 \times 10^{-7}$	$c_0 = 1.185\,976 \times 10^2$
$b_5 = -5.607\,284\,4889 \times 10^{-10}$	$c_1 = -1.183\,432 \times 10^{-4}$

Dependence of voltage in mV on temperature:

°C	0	-10	-20	-30	-40	-50	-60	-70	-80	-90
-200	-5.891	-6.035	-6.158	-6.262	-6.344	-6.404	-6.441	-6.458		
-100	-3.554	-3.852	-4.138	-4.411	-4.669	-4.913	-5.141	-5.354	-5.550	-5.730
0	0.000	-0.392	-0.778	-1.156	-1.527	-1.889	-2.243	-2.587	-2.920	-3.243

°C	0	10	20	30	40	50	60	70	80	90
0	0.000	0.397	0.798	1.203	1.612	2.023	2.436	2.851	3.267	3.682
100	4.096	4.509	4.920	5.328	5.735	6.138	6.540	6.941	7.340	7.739
200	8.138	8.539	8.940	9.343	9.747	10.153	10.561	10.971	11.382	11.795
300	12.209	12.624	13.040	13.457	13.874	14.293	14.713	15.133	15.554	15.975
400	16.397	16.820	17.243	17.667	18.091	18.516	18.941	19.366	19.792	20.218
500	20.644	21.071	21.497	21.924	22.350	22.776	23.203	23.629	24.055	24.480
600	24.905	25.330	25.755	26.179	26.602	27.025	27.447	27.869	28.289	28.710
700	29.129	29.548	29.965	30.382	30.798	31.213	31.628	32.041	32.453	32.865
800	33.275	33.685	34.093	34.501	34.908	35.313	35.718	36.121	36.524	36.925
900	37.326	37.725	38.124	38.522	38.918	39.314	39.708	40.101	40.494	40.885
1000	41.276	41.665	42.053	42.440	42.826	43.211	43.595	43.978	44.359	44.740
1100	45.119	45.497	45.873	46.249	46.623	46.995	47.367	47.737	48.105	48.473
1200	48.838	49.202	49.565	49.926	50.286	50.644	51.000	51.355	51.708	52.060
1300	52.410	52.759	53.106	53.451	53.795	54.138	54.479	54.819		

The temperature dependence of voltage on temperature with 1 degree Celsius increments is shown in EN 60584-1.

Tolerance classes of accuracy

Tolerance classes for K thermocouples are defined by EN 60584-2.

Thermocouple designation	Tolerance class	Permissible deviations (°C)	
K	1	$\pm 1.5\text{ °C}$ $\pm 0.004 * t $ °C	for temperatures of -40 to +375 °C for temperatures of +375 to +1000
	2	$\pm 2.5\text{ °C}$ $\pm 0.0075 * t $ °C	for temperatures of +40 to +333 °C for temperatures of +333 to +1200
	3	$\pm 2.5\text{ °C}$ $\pm 0.015 * t $	for temperatures of -167 to +40 °C for temperatures of -200 to -167 °C

Sensit temperature sensors based on K thermocouples

Currently only cable (standard and custom) temperature sensors are produced with these sensing elements.

Note: An overview of cable (standard and custom) temperature sensors can be found at www.sensit.cz or in the Sensit catalogue.