TH2

SONDERENTWICKLUNGEN
MESSTECHNIK

General

The dual channel amplifier TH2 puts out two voltages which are proportional according to the connected two type-K-thermocouple's temperatures.
TH2 amplifies the voltage difference which is caused by the difference between the thermocouple's temperature and the temperature of the amplifier TH2. Since the absolute temperature of the thermocouple is subject of interest, the temperature of the TH2 is internally measured and the output signal is correspondingly compensated.

Output Signal

Each of the two channels may work in one of four temperature ranges, where each temperature range has its own signal amplification a.

Range R	Ampl. $a(R)$	$T_{min}(R)$	$T_{max}(R)$
1	4 mV/°C	-50 °C	1150 °C
2	10 mV/°C	-50 °C	430 °C
3	20 mV/°C	-50 °C	190 °C
4	26.66 mV/°C	-50 °C	130 °C

Depending on the temperature range R and the thermocouple's temperature T, the output voltage U_O is defined as $U_O(T) = a(R) \cdot (T + 50\ °C)$.

The output voltage range is from –4 V to 4.8 V. Negative voltages may not appear in standard applications since they indicate either temperatures below –50 °C or a defect of the thermocouple.

TH2 does not correct the linearity error of the type-K-thermocouples. TH2 is calibrated for range $R = 2$ at 0 °C and 300 °C. Within this range TH2 has a maximal absolute error (incl. thermocouples' linearity errors) of 3 °C. If not working within this range, the measurement error is received by taking both, the maximal absolute error of the internal temperature compensation (= 2 °C) and the maximal relative error of the amplifier (= 1 %) into account.

Setup of TH2

The position P of the switch defines the temperature range R_1 of the first thermocouple and also the temperature range R_2 of the second thermocouple. Internally each switch position is labelled with the hexadecimal number $L(P)$.

Pos. P	$L(P)$	$R_1(P)$	$R_2(P)$	$T_{max}(R_1)$	$T_{max}(R_2)$
0	0	1	1	1150 °C	1150 °C
1	1	2	1	430 °C	1150 °C
2	2	3	1	190 °C	1150 °C
3	3	4	1	130 °C	1150 °C
4	4	1	2	1150 °C	430 °C
5	5	2	2	430 °C	430 °C
6	6	3	2	190 °C	430 °C
7	7	4	2	130 °C	430 °C
8	8	1	3	1150 °C	190 °C
9	9	2	3	430 °C	190 °C
10	A	3	3	190 °C	190 °C
11	B	4	3	130 °C	190 °C
12	C	1	4	1150 °C	130 °C
13	D	2	4	430 °C	130 °C
14	E	3	4	190 °C	130 °C
15	F	4	4	130 °C	130 °C

TEMES parameters (General)

The parameters which are used by TEMES to define a linear relationship between physical value p and input signal v are not (as commonly used) polynomial coefficients. Instead, TEMES uses two distinct points $P_0 = (v_0, p_0)$ and $P_1 = (v_1, p_1)$ of a two dimensional space, which is spanned by the input signal and the physical value. Then the relationship is given by the line through these two points. The coordinates of the two points are given by the first physical value p_0, the corresponding input signal v_0, the second physical value p_1 and the corresponding input signal v_1. Note that p_1 must not equal p_0 and v_1 must not equal v_0.
Factor m and offset t are used to describe the linear relationship with polynomial coefficients. Thus, $p(v) = m \cdot v + t$.

Factor, Offset	Example for two points
$m = (p_1 - p_0) / (v_1 - v_0)$ $t = p_0 - m \cdot v_0$	P_0: $v_0 = 0$, $p_0 = t$ P_1: $v_1 = 1$, $p_1 = m + t$

TEMES parameters (TH2)

Range R	$p_0(R)$	$v_0(R)$	$p_1(R)$	$v_1(R)$
1 (1150 °C)	0 °C	0.2 V	300 °C	1.4 V
2 (430 °C)	0 °C	0.5 V	300 °C	3.5 V
3 (190 °C)	0 °C	1 V	150 °C	4 V
4 (130 °C)	0 °C	1.333 V	100 °C	4 V

Pin Assignment

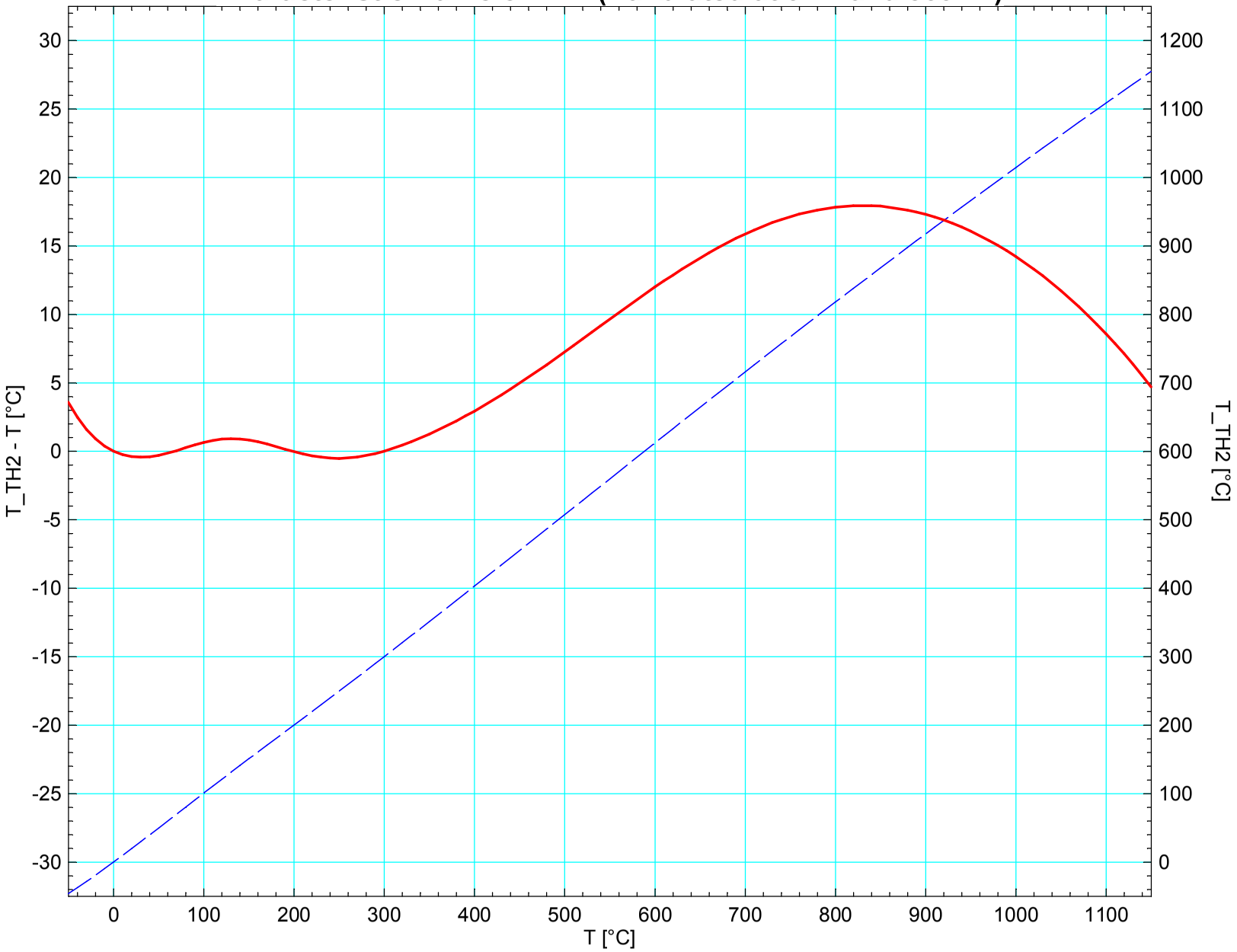
Output plug: This plug is manufactured by Binder (Binder Series 719). It supplies the TH2 with voltage and puts out the temperature dependent voltages.

Pin	Assignment [Cable colour]
1	Supplying voltage (7 V to 16 V DC) [red]
2	Ground [brown]
3	Output Channel 1 [black]
4	Output Channel 2 [orange]
5	(unused)

Mechanical Data

Length × Width × Height: 40 mm × 30 mm × 14 mm

Characteristic Curve of TH2 (Calibrated at 0 °C and 300 °C)



Thermocouple amplifier TH2
for thermocouples of type K

T: Real temperature
T_TH2: Measured temperature

T_TH2(T=-50°C) = -46.424 °C
T_TH2(T=-40°C) = -37.528 °C
T_TH2(T=-30°C) = -28.410 °C
T_TH2(T=-20°C) = -19.096 °C
T_TH2(T=-10°C) = -9.634 °C
T_TH2(T=0°C) = 0.000 °C
T_TH2(T=50°C) = 49.693 °C
T_TH2(T=100°C) = 100.639 °C
T_TH2(T=130°C) = 130.917 °C
T_TH2(T=150°C) = 150.823 °C
T_TH2(T=190°C) = 190.145 °C
T_TH2(T=200°C) = 199.975 °C
T_TH2(T=250°C) = 249.472 °C
T_TH2(T=300°C) = 300.000 °C
T_TH2(T=430°C) = 434.112 °C
T_TH2(T=500°C) = 507.262 °C
T_TH2(T=800°C) = 817.818 °C
T_TH2(T=900°C) = 917.302 °C
T_TH2(T=1000°C) = 1014.230 °C
T_TH2(T=1150°C) = 1154.706 °C

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