

Temperature Compensation with PICOSTRAIN in Practice

1 Target

Temperature compensation for load cells or complete scales, individually or in lots, at low expenses and little mathematical complexity only with parameter settings of PS021.

2 General Method

Six measurements have to be done with the load cell or scale, close to the lower and upper limit of the temperature specification, near zero load and about maximum load, at a given configuration for the PS021. The configuration parameters TKOffs and TKGain can be calculated from these six results, based on a linear approximation for the temperature dependency. It is assumed that non-linearities can be neglected.

3 Possible Applications

This kind of mathematical correction for span and offset error can be used only with bridges that have one, and only one, span compensation resistor (un-balanced bridges).

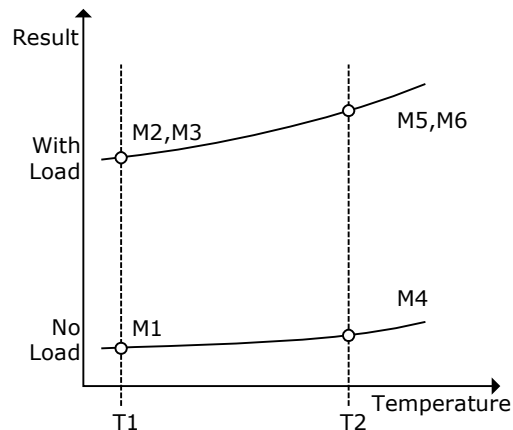
4 Basic Configuration

The method can be used for one or two PICOSTRAIN fullbridges and also for one or two Wheatstone bridges. The measurements are done at high averaging rate (e.g. 100).

5 Edge Conditions

Generally it is not a simple task to perform a temperature measurement on a load cell. The reason is, that many disturbances and influences can make the obtained result useless. Therefore, it is recommended to pay attention to several aspects which we provide as hints in the following:

- perform the measurement with a load near zero and roughly maximum load
- perform the measurement at T1 and T2 where ΔT is > 30 K
- choose a large settling time (> 1.5 h) in order to make sure the whole system has the same temperature
- mark the area where to set the load on your weighing plate in order to avoid diffusion
- choose the settings for the software according to the recommendations in 'Basic Software Settings' in this document



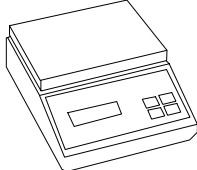

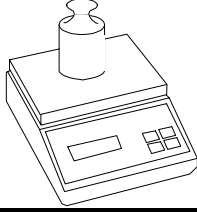
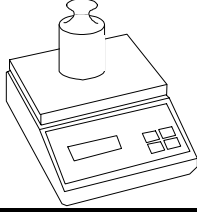
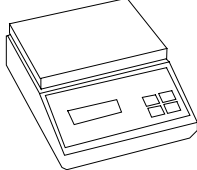

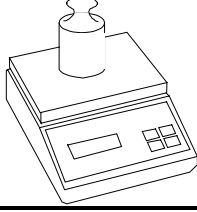
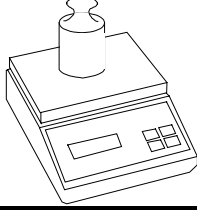
6 Basic Software Settings

full scale of display:	2000 ppm	WarmUp & Mfake	3
sensitivity:	2 mV/V	ModRSpan on	ON (checked)
Mult1/2 enable:	ON (checked)	Mult Rspan 1 / 2	0
Sign_Mult1/2	OFF (unchecked)	Corr Offset 1 / 2	0
Offset & Average	OFF		
SubFB	ON (checked)		
AV-Rate	> 100		
CycleTime	> 250		

Note: TkOff may also have an initial value different from 0. This might be reasonable in case of non-adjusted bridges with a very large zero offset. Measuring without a rough pre-setting of the TKOffs would give quite a high offset drift, leading to additional errors. In this case it is helpful to start with a TKOffs value close to the real zero offset. In this case the initial TKOffs value has to be added to the calculated result.

7 Performing the Measurement

In the calibration measurement itself there are 6 values captured. The following table shows the 6 measurements in detail. Please write down the values M1..M6 in order to calculate the correction factors afterwards with the formulas given in 'Calculation of the Correction Factors' or use directly the provided Excel-sheet to calculate them.

M1:	$= M(T1, L0, TkG0)$ Result with TKGain1 = 0 & TKGain2 = 0 (TkG0) at lower temperature (T1) and no load (L0)	No Load 	Cold  T1, e.g. 10°C
M2:	$= M(T1, L1, TkG0)$ Result with TKGain1 = 0 & TKGain2 = 0 (TkG0) at lower temperature (T1) and load (L1)	Max. Load 	
M3:	$= M(T1, L1, TkG1)$ Result with TKGain1 = 1 & TKGain2 = 1 (TkG1) at lower temperature (T1) and load (L1)		
M4:	$= M(T2, L0, TkG0)$ Result with TKGain1 = 0 & TKGain2 = 0 (TkG0) at upper temperature (T2) and no load (L0)	No Load 	Warm  T2, e.g. 40°C
M5:	$= M(T2, L1, TkG0)$ Result with TKGain1 = 0 & TKGain2 = 0 (TkG0) at upper temperature (T2) and load (L1)	Max. Load 	
M6:	$= M(T2, L1, TkG1)$ Result with TKGain1 = 1 & TKGain2 = 1 (TkG1) at upper temperature (T2) and load (L1)		

8 Calculation of the Correction Factors

The correction factors are calculated according to the formulas:

$$\text{TKOffs} = \frac{M4 \times M2 - M1 \times M5}{(M4 + M2) - (M1 + M5)}$$

$$\text{TKGain} = \frac{(M5 - M4) - (M2 - M1)}{(M2 - M1) \left(\frac{M5}{M6} - 1 \right) - (M5 - M4) \left(\frac{M2}{M3} - 1 \right)}$$

Alternatively you can use an Excel-Sheet to calculate the values easily and automatically. The Excel-sheet is also provided by acam (blablab.xls).

9 Use the Correction Factors

After determining the factors they can be directly applied in the PSA21 software. Therefore, please select the 2nd tab page which is labeled 'Expert' and insert the TKGain value at 'Mult Rspan 1' and the TKOffs value at 'Corr Offset 1'.

Alternatively, write the correction factors into the appropriate TKGain and TKOffs registers of the PS021 within your application.