

Span-Temperature-Drift Compensation

Span is the net output signal of sensors. Span-temperature-drift is the change in the span of sensors, which is induced by the temperature change of the sensor body and is originally caused due to the change in ambient temperatures.

The span-temperature-drift can be compensated by means of the Young's-modulus-compensation resistors (or span-temperature-compensation (SC) resistors) from BCM SENSOR, for example, the [ENF-series or EBF-series bondable SC resistors](#). Illustrated in Fig. 1 below is the corresponding bridge circuit using two ENF-25A-FE bondable SC resistors. The reason to use two ENF-25A-FE bondable SC resistors is to make the bridge circuit electrically symmetric, which is in favor of the subsequent SSC (sensor signal conditioning) electronics. But one can also use one ENF-50A-FE SC resistor in case the space to bond the SC resistors is limited. The total resistance of the SC resistor(s) can be calculated approximately according to the following formula:

$$R_E \approx [(S_{O1} - S_{O2}) \cdot R_{IN}] / \{[1 + \alpha_E \cdot (T_1 - T_2)] \cdot S_{O1} - S_{O2}\}$$

Where,

- R_E = the total resistance of SC resistor(s);
- $S_{O1} = U_{O1}/U_{EXC}$ = the output sensitivity of sensor at the temperature T_1 , and U_{O1} = the output voltage at the temperature T_1 ;
- $S_{O2} = U_{O2}/U_{EXC}$ = the output sensitivity of sensor at the temperature T_2 , and U_{O2} = the output voltage at the temperature T_2 ;
- R_{IN} = the input resistance of bridge circuit at T_1 ;
- α_E = the temperature coefficient of resistance of the SC resistor.

As R_E is referred to as the total resistance of SC resistor(s), if only one single SC resistor (for instance, 50 Ω) is used, then R_E is the resistance of this SC resistor, i.e., 50 Ω , resulting in an asymmetric bridge circuit. As mentioned above such asymmetric circuit is not favorable to the SSC electronics, because a part of sensor output signal will more likely be saturated. Therefore, it is recommended to have a symmetric circuit. To do so, one can make use of two SC resistors of same resistance and each SC resistor has its resistance of $R_E/2$. Specifically, in this case, the resistance of each SC resistor is 25 Ω , as shown by Fig.1.

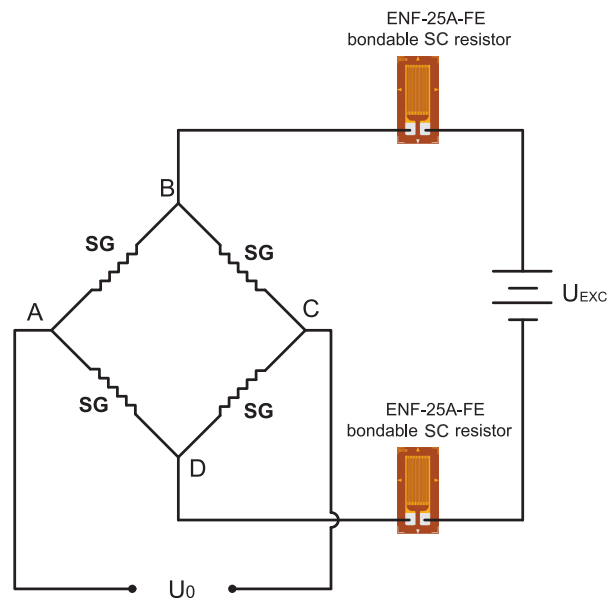


Fig. 1: Symmetric Circuit Using ENF-25A-FE to Compensate Span-Temperature-Drift

In case there is no space on the sensor body to bond the SC resistors, one can make use of the [EMC gauges](#) which can compensate the span-temperature-drift of sensors.

The further detailed discussion on the span-temperature-drift and its corrections will be specifically conducted in the technical note of [EMC gauges](#).