Sensor measurements with AD24USB

Many sensors don't produce simple output voltage, most of them require some additional circuitry. A support for these sensors is built in the module AD24USB, but an appropriate terminal for specific sensor type is necessary. The AD24USB supports these sensor types:

1. **Thermocouples**: A cold junction compensation (CJC) is necessary for temperature measurements with thermocouples. This compensation requires an input terminal with a known temperature. An output voltage from the thermocouple is low – typical thermocouple sensitivity is some tens µV/ºC, so a very sensitive AD converter is necessary. The AD24USB is perfectly suited for this task – it is a very low noise high-resolution module, galvanic isolation from USB and integrating conversion principle brings high immunity to unwanted noise. An offset of the AD24USB is very low – below 2 µV, the noise of the AD24USB SE is below 150 nVpp, the noise of the AD24USB dif with input chopping is below 40 nVpp. CJC is implemented in software together with linearization polynomial, so modification according thermocouple type is very simple.

2. **Resistive bridges** – typical example is a strain gauge. The bridge requires excitation voltage and differential input of the AD converter which senses output voltage. Typical connection to the AD24USB shows fig. 1.

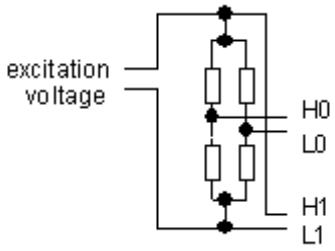

Fig. 1

Excitation voltage has usually a value of some volt DC. This solution isn't suitable for accurate measurements, because typical sensitivity of strain gauge is only 2 mV/V, so resulting voltage is only 10 mV for excitation voltage 5 V. Accurate measurement of such low voltages is difficult, parasitic thermoelectric voltages in wires and offset and noise of the AD converter are a big problem. The AD24USB is equipped with excitation source with commuted polarity for an elimination of the mentioned error sources. The AD24USB measures output bridge voltage for both polarities of the excitation voltage and then subtracts both results. Parasitic thermoelectric voltages and input offset are removed together with 1/f noise this way and bring significant noise reduction.

Noise can be as low as 15 nVpp with measurement speed 1 sample/sec. The excitation voltage is measured directly on the bridge, so the influence of the wire resistance is also removed.

3. **Resistance measurements –** the most usual example is a temperature sensor Pt100. The AD24USB uses ratiometric measurement shown on Fig.2., again with alternating of the excitation current. A lower level of the current can be used due to modulation, so a self heating error can be greatly reduced.

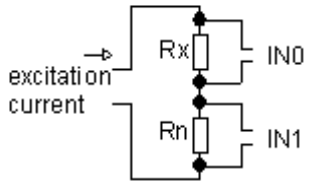

Fig. 2

Measured resistance is : Rx = Rn * Ux/Un (1)

Formula (1) shows that result is independent of the value of the current, accuracy is given only by the accuracy of the normal resistance Rn and the ratio of the two voltages.

Due to the AC excitation measured voltage can be only a few tens of mV, so current 0.5 mA gives power loss on 100 ohms only 25 uW and temperature resolution limited by noise of theAD24USB is 0.0001 ºC.

Conclusion: The AD24USB is a perfect choice for the highest accuracy measurements with various types of sensors due to its high-resolution AD converter and the AC modulation of input or excitation output. Thanks fast input settling the AD24USB is a very good choice also in multiplexed systems with more sensors.

Note. The AD24USB has either a voltage or current source, for details contact manufacturer.