Constant voltage biasing

The operation and read-out of the XEN-3880 (=XEN-TCG3880) can be done very simple. A non-feedback type of biasing is the easiest to implement. In this case, the heater is supplied with a constant voltage, current, or power supply of mixed characteristic. The output voltage is measured using a (digital) multimeter (DMM) or using an AD-converter. If the DMM is of adequate quality and with sufficient input resistance, it can directly measure the output volt-age of the XEN-3880. The simplest biasing scheme for a gas-type determination is shown in Fig. 1, where a series resistance of 2 kOhm is inserted before the heater to minimize the overall temperature coefficient of the output voltage (*see also the Application note on the Temperature Coefficient*). In general, an output voltage up to 200 mV can be generated with a noise level at 1 Hz bandwidth of the order of 0.2 μV_{p-p} to get 20 bits of resolution. Thus, a good 6.5-digit DMM is required to take full advantage of the XEN-3880 potential.

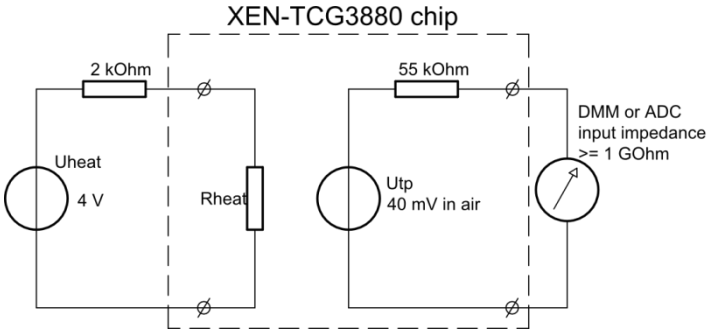

Figure 1: Constant voltage biasing of the XEN-3880 with 2 kOhm series resistance for minimizing temperature effects on the output voltage in case of gas type measurement.

For vacuum measurements, no simple temperature coefficient elimination is possible over the entire pressure range from 0 Pa to 100 kPa, and the best is to bias from a pure voltage source, as shown in Fig. 2.

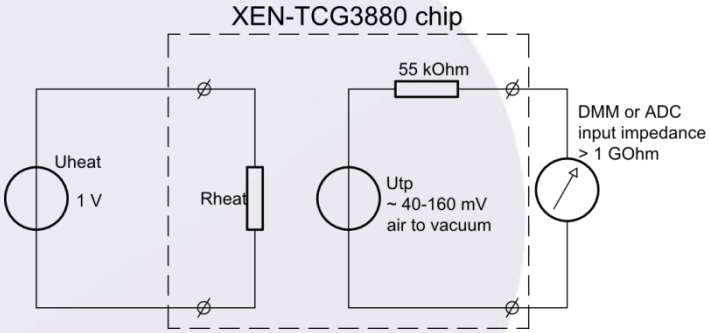

Figure 2: Constant voltage biasing of the XEN-TCG3880 for vacuum measurement.

Output signal amplifying or buffering

In case of read out of the output voltage with an ADC with inadequate range or input resistance, the output signal needs to be amplified or buffered first. Depending upon the electronics used various OpAmps can be applied. A good and economic opamp for this is the OP177, which has a low offset voltage (60 μV) and not too much input bias current (few nA), thus resulting in an overall low offset voltage and offset voltage drift. The offset voltage is equal to the OpAmp offset voltage, plus the OpAmp input bias current multiplied by the XEN-3880 output resistance of 55 kOhm.

The OP177 has, however, the disadvantage that it does not have a rail-to-rail input or output voltage. For applications where you want to use a single 0-5 V power supply, other OpAmps with rail-to-rail operation at 0-5 V power supply are preferred. Here you should also consider the offset voltage and the input bias current of the OpAmp. Chopper stabilized OpAmps with very low offset (1 μV) and very low input bias currents (picoAmps) can also be interesting in combination with the XEN-3880. Usually speed and slew rate are of less importance, while noise, particularly for chopper OpAmps, might be of importance. A good loop gain can be important to obtain a good input impedance and thus a good accuracy.

Feedback biasing

Using feedback, the output voltage of the sensor can be stabilized or given a predetermined pattern by electronically adjusting the biasing of the heater. Here, more elaborate electronics can be required with a DAC imposing the desired output voltage to be compared with the actual output voltage. Such electronics are beyond the scope of this application note.