APPLICATION NOTE

HE144 Hall sensor offset compensation

Offset voltage

The offset voltage of a Hall sensor is defined as the output voltage at a magnetic field of 0.0 Tesla. This voltage is only an offset and does not influence magnetic behaviour of the sensors.

For several technical reasons, Hall sensors show an output offset voltage. The Asensor Technology AB type HE144 Hall sensor is no exception.

Advantage of the Asensor Technology AB HE144 sensor

There is a difference between the Asensor Technology AB sensors and other sensors that give the HE144 type an advantage: where other Hall sensors express the offset voltage as a change of the offset voltage (in %) with temperature, this is **not** the case with the Asensor sensors. The temperature drift is not only low, it also does not depend on the offset voltage one would calculate when seeing a sensor as a Wheatstone bridge!

This leads to a sensor with good and predictable temperature behaviour. To be able to really use the advantages of these sensors, care must be taken with the current source and offset correction.

If you really need a very low offset and low drift on it, it is better to use the HE244.

Current source

It is advised to drive the sensors with a constant current. This is the only correct way to use the sensors precisely as this is what a Hall sensor is based on: current. Of course it is possible to drive the sensors with a voltage for less precise applications. But then the current through the sensor will depend on the sensor resistance, hence temperature.
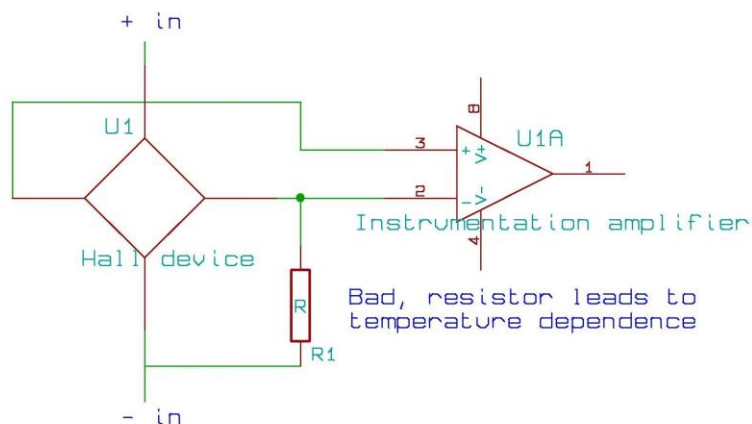
Offset compensation

The HE144 sensor is well balanced for optimal temperature behaviour. Using external resistors for offset correction, changes this balance and introduces a thermal drift of the offset voltage! It is important with such precise Hall sensors that you use high impedance buffers (like instrumentation amplifiers, opamps) at the outputs. Offset correction can be done after the buffers, or even in software. Care must be taken not to saturate amplifiers with the offset voltage.

Notice that in several examples, schematics and application notes that can be found on the internet, resistors are connected to the Hall sensor to compensate for offsets. This is the wrong method! Only the methods described here are correct for the HE144 sensor. Even though they do not have a real offset or drift, it is also recommended not to connect resistors to the HE244 and 3D HE444 Hall sensors as it will influence their behaviour too.
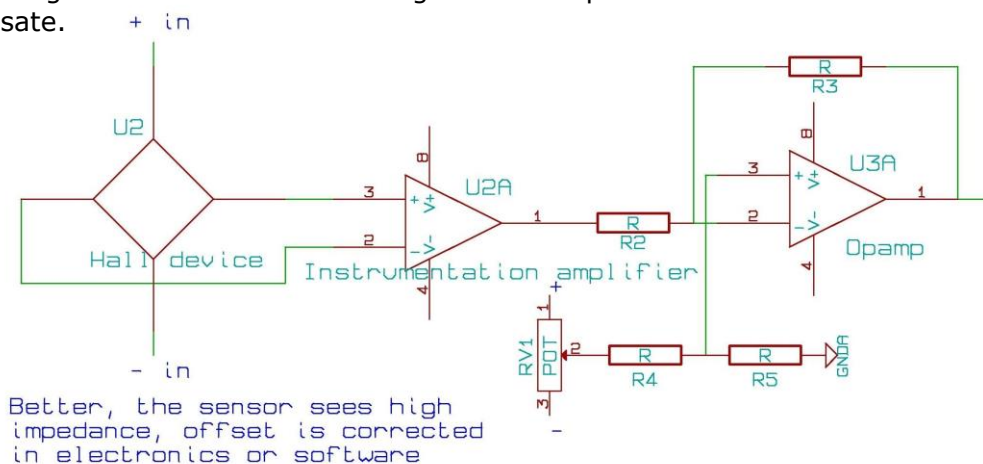
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Here are two examples, a bad and a good way to compensate for offset voltages:

The example above leads to a temperature drift of the offset voltage. Meaning that the offset voltage is not constant but changes with temperature and is difficult to compensate.

This is just an example of an offset voltage correction that gives good results. There are many other ways to compensate for offset voltages. As the electronics already has a current source, it is good practice to use the reference used for that current also as reference for compensation of offset voltages. This will cancel out part of the temperature drift of your electronics.

You first buffer (maybe with a smaller gain) the Hall sensor with the instrumentation amplifier, then after this stage you cancel the offset and can do large amplifications.

Many other ways to correct for offset voltages can be found in several application notes for compensation of opamp and instrumentation amplifier offset voltages.

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