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Interactive comment on "Possibilities of further improvement of 1-second fluxgate variometers" *by* Andriy Marusenkov

Anonymous Referee #2

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Andriy Marusenkov's paper "Posibilities of further improvement of 1-second fluxgate variometers" is mainly targetted to fluxgate supporting electronics. It is then obvious, that detailed description of sensor construction is not present. But there is possibility to refinement at several points. Next comments are related to the corrected paper (Marusenkov_PossibFHMimprov_1.pdf):

Page 1, last row: What does the used term "Crystal permalloy" mean? Is the material monocrystal? Within the cristalline materials, we can divide between coarse or fine grain structure. Can this be specified better?

Page 2, row 8 In the second harmonic FG, process of annealing in the large DC field perpendicularly to excitation (so called thermomagnetic processing) can improve noise performance , but there is no information about magnetic field (intentional or uninten-

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Discussion paper

tional i.e. residual field in the furnace) of the sensor during the annealing described in the text.

Page 3, row 15 In the text, there is a vague information about "Chemical current source". Anyone would expect kind of saturated chemical current source (i.e. mercury-drop electrode of J.Heyrovsky). But after looking into Ciofi's paper, it can be seen, that normal HgO-Zn galvanic cell is used instead of "buried Zener" for voltage reference and voltage-to-current converter must be present here to obtain the needed current. It is not "chemical current source" sensu stricto but a "current source with chemical voltage reference". There are other informations of using (currently worldwide banned by for example ROHS directive) mercury cell as a voltage reference, which has (when oven controlled) better short-time noise performance, that common "buried Zener" references i.e. here: https://dev.xdevs.com/projects/rnd/repository/changes/CERN/ug_thesis_2005_borrero.pdf?rev=a1a73de296c9 The term "buried Zener" is common semiconductor vendor's slang for subsurface avalanche diode and has nothing to do with Zener tunelling, which can be made much more quieter at cost of different thermal dependence and with worse stabilisation factor. In avalanche diode, breakdown occurs in the place of the high potential gradient which is (in usual planar diode) near the surface. By dedicated technological process (as I can remember, developed by Raytheon in 1960s) this high potential gradient region can be made deep in the semiconductor bulk and the device is thus much more stable.

Page 4, row 4 The term "crystal" is usually reserved for piesoelectric quartz. The term "die" is used for monolithic part of silicon. Your description resembles, that piesoelectric element on the die is used for temperature stabilisation, which is not this case. In both LM199 and LTZ1000, temperature dependence of emitter junction is used for die stabilisation.

Page 4, row 25 We do not need to have temperature dependence linear. We need voltage independent to temperature in "Chebyschev" sense. Result of our effort is to

make system temperature independent, not linearly dependent.

Page 5, row 25 When You have problems with Vishay SMD components stress sensitivity, why do not You using through-hole parts at critical points of construction? Vishay is still manufacturing hermetic bulk-foil resistors and hermetic manganina resistors in former RFT plant (as I can remember) in Teltow.

Page 7, row 10 For reason written upper. "non-linearity" can be replaced with "non-uniformity".

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