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Geoscientific Instrumentation Methods and Data Systems
Discussions

# *Interactive comment on* "Calibration of QM-MOURA three-axis magnetometer and gradiometer" *by* M. Díaz-Michelena et al.

**Anonymous Referee #1**

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The paper discusses the on-ground calibration of a gradiometer with two AMR based triaxial sensors which was developed for a future lander mission to Mars. The paper is in principle very interesting to the community but it lacks some elements which are of importance for being accepted for the journal. It can be suggested for publication with some rework based on the general and specific comments below.

General Comments:

It is difficult to review a calibration paper which doesn't include a description of the instrument design. For example, the authors mention the calibration of the inner coil but it is not described what it is exactly (is it the offset strap?) and whether there is also an outer coil that is used for feedback; another important aspect for the quality of an



AMR based instrument is the form of the set and reset pulses.

Expressions like 'future papers' and 'forthcoming work' are mentioned in several paragraphs of the paper. It might be summarized in a separate outlook chapter at the end of the paper.

The authors mention the scientific objectives in the introduction and that the QM was slightly reworked to enable scientific test measurement on Earth. There is a lack of performance requirements for the test measurements on Earth (as well as at Mars) and a discussion is missing to what extent they are fulfilled by the calibration results.

The paper is partly written like a test report which still includes many procedure like listings. They are mostly not of importance for the reader.

It is understood that the design is driven by very limited mass, power and size constraints. But nevertheless, there should be a comparison made with existing literature (e.g. Brown, P., et al. "Magnetoresistive magnetometer for space science applications". Measurement Science and Technology 23, Nr. 2 (2012) and Ripka, P. et al. "Temperature Stability of AMR Sensors". Sensor Letters 11, Nr. 1 (2013): 74–77. oi:10.1166/sl.2013.2807.).

The authors do not discuss the performance parameters of the data sheet of the selected AMR chip and how they compare with their own results: gain drift, offset drift, noise floor ...

There is redundant information in the tables and the figures which just extends the length of the paper: the content of Tab. 11 also shows up in Tab. 12; all six curves in Fig. 8 look pretty much the same ...

An assumption is mentioned about the maximum angular deviation of the AMR sensor element at the end of the introduction part of Chap. 3.2. This should be explained in more detail.

It is not understood why delta-offset can be the same as delta-gain (Chap. 3.2.1). The

offset drift is normally measured in low field to separate it from the gain drift. It's always the same independent from the magnitude of the measured field while the gain drift is a parameter which multiplies with the magnetic field as pointed out e.g. in Equ. (17). So, how can it be the same?

The comparison of the daily variation as presented is meaningless. The difference is too big and so it can be the spatial separation between the observatory and the test site of MOURA as well as the instability of the MOURA instrument. It is mentioned at the end of Chapter 4 that comparison measurements will be done in an observatory in the future. Maybe this has been done already and can now be included. It should then also include a comparison on component level.

The conclusion is not completely right because offsets and orthogonality have not been characterized with temperature. Furthermore, it is said in the conclusion that the 'Results are in agreement with the expected resolution' but it is not explained what the expected resolution is?

Since there is obviously no feedback mode implemented, cross field effects must be taken into account and discussed.

Specific Comments:

Why are the parameters of FG-100 listed in Tab.3 when it is not used for reference measurements?

Why is the gain drift of sensor 2 almost two times higher than the gain drift of sensor 1?

Technical corrections:

Typo in the conclusion: '... restricted temperature range from -60 to ...

Typos in Equation 17.

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Interactive comment on Geosci. Instrum. Method. Data Syst. Discuss., 4, 385, 2014.