

Title: Establishing standards for calibration on digital sensing system for acoustics and vibration

Abstract

Digital sensing systems are used for measurements in the fields of acoustics, ultrasound and vibration. However, at present, the vast majority of the calibration systems used for digital sensing are not adapted to comply with the re-digitalised signals and current standards do not describe how to calibrate such systems. Therefore, there is a need for the standardisation of the calibration of digital sensing system for acoustics and vibration and for input into standards committees such as ISO TC 43, ISO TC 108, IEC TC 29 and IEC TC 87. In particular, standardised metrics to validate procedures for the performance of digital sensing systems are needed, as well as agreed measurements protocols and calibration procedures based on comparison with analogue systems.

Keywords

Acoustics, vibration, digital sensors, calibration, ultrasound, standardisation

Background to the Metrological Challenges

In the current fields of acoustics and vibration there are many devices available for digital sensing such as those used to measure sound in the ocean (e.g. marine autonomous recording devices) or air acoustics used in microphones. However, there are issues surrounding the calibration of such digital sensing and standard methods for the performance of digital sensing systems do not exist. Often this causes delays in obtaining data according to industrial stakeholder's needs and thus, there is a need for methods for specifying and validating signal processing and data analysis, according to documented industrial stakeholder requests and priorities.

Current, metrological challenges with regards to the calibration of digital sensing systems for acoustics and vibration include the determination of key performance metrics such as the measurement of low ambient levels and dynamic ranges for high amplitude signals, the handling of large volumes of data as well as a lack of access to the analogue voltage signals. However, analogue voltage signal is available in the traditional transducer calibration procedure and therefore, validated procedures for the calibration of digital sensing system, based on comparison with analogue systems need to be developed.

Likewise, there is presently no single standard method for measuring the digital output of microphones in digital sensing systems and motion sensors such as accelerometers or gyroscopes used in electronic products. Therefore, in order to address this agreed and standardised measurement protocols for specifying and validating signal processing and data analysis are required.

In support of the need to standardise the calibration of digital sensing system, the technical committees ISO TC 43, ISO TC 108, IEC TC 29 and IEC TC 87 and the EU Technical Group on Underwater Noise (EU TG Noise) have all expressed their support for adopting new calibration standards and providing guidance on the calibration of digital sensing system for acoustics and vibration.

Objectives

Proposers should address the objectives stated below, which are based on the PRT submissions. Proposers may identify amendments to the objectives or choose to address a subset of them in order to maximise the overall impact, or address budgetary or scientific / technical constraints, but the reasons for this should be clearly stated in the protocol.

The JRP shall focus on metrology research necessary to support standardisation for the calibration of digital sensing systems for acoustics and vibration.

The specific objectives are

1. To develop standardised metrics, terminology and validated procedures for the performance of digital sensing systems
2. To develop agreed measurement protocols for instrument and sensor calibration and methodologies for specifying and validating signal processing and data analysis, according to documented industrial stakeholder requests and priorities.
3. To develop validation procedures for calibration, based on their comparison with analogue systems.
4. To collaborate with the technical committees ISO TC 43, IEC TC 29, IEC TC 87 and ISO TC 108, and the users of the standards they develop to ensure that the outputs of the project are aligned with their needs, including the provision of guidance on the calibration of digital sensing system for acoustics and vibration and recommendations for incorporation of this information into future standards at the earliest opportunity.

The proposed research shall be justified by clear reference to the measurement needs within strategic documents published by the relevant Standards Developing Organisation or by a letter signed by the convenor of the respective TC/WG. EURAMET encourages proposals that include representatives from industry, regulators and standardisation bodies actively participating in the projects. The proposal must name a “Chief Stakeholder”, not a member of the consortium, but a representative of the user community that will benefit from the proposed work. The “Chief Stakeholder” should write a letter of support explaining how their organisation will make use of the outcomes from the research, be consulted regularly by the consortium during the project to ensure that the planned outcomes are still relevant, and be prepared to report to EURAMET on the benefits they have gained from the project.

Proposers should establish the current state of the art, and explain how their proposed research goes beyond this. In particular, proposers should outline the achievements of the EMPIR projects 15RPT02 UNAC-LOW and 15HLT03 EARS II and how their proposal will build on those.

EURAMET expects the average EU Contribution for the selected JRPs in this TP to be 0.6 M€, and has defined an upper limit of 0.8 M€ for this project.

EURAMET also expects the EU Contribution to the external funded partners to not exceed 30 % of the total EU Contribution to the project.

Any industrial partners that will receive significant benefit from the results of the proposed project are expected to be unfunded partners.

Potential Impact

Proposals must demonstrate adequate and appropriate participation/links to the “end user” community, describing how the project partners will engage with relevant communities during the project to facilitate knowledge transfer and accelerate the uptake of project outputs. Evidence of support from the “end user” community (e.g. letters of support) is also encouraged.

You should detail how your JRP results are going to:

- Address the SRT objectives and deliver solutions to the documented needs,
- Feed into the development of urgent documentary standards through appropriate standards bodies,
- Transfer knowledge to manufacturers and suppliers of sensor systems, and industries using acoustics and ultrasound technologies.

You should detail other impacts of your proposed JRP as specified in the document “Guide 4: Writing Joint Research Projects (JRPs)”.

You should also detail how your approach to realising the objectives will further the aim of EMPIR to develop a coherent approach at the European level in the field of metrology and include the best available contributions from across the metrology community. Specifically the opportunities for:

- improvement of the efficiency of use of available resources to better meet metrological needs and to assure the traceability of national standards
- the metrology capacity of EURAMET Member States whose metrology programmes are at an early stage of development to be increased
- organisations other than NMIs and DIs to be involved in the work

Time-scale

The project should be of up to 3 years duration.