

## Certificate of Calibration

<b>Calibration of:</b>	A ¼" ELECTRET ARRAY MICROPHONE
<b>Manufacturer:</b>	TMS
<b>Model number:</b>	130C10, 130P10
<b>Serial number:</b>	12701, 12596
<b>Calibrated for:</b>	BUSINESS ENTERPRISES AT UNIVERSITY OF PRETORIA Pretoria
<b>Calibration procedure:</b>	AVAS-0004
<b>Period of calibration:</b>	28 September 2011


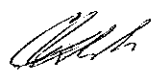
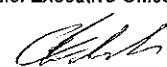
### 1 PROCEDURE

The sensitivity of the microphone preamplifier assembly was determined by measuring the output voltage of the microphone preamplifier assembly in response to an applied reference sound pressure level.

The results of the measurements are traceable to the national measurement standards.

The following equipment was used:

Brüel & Kjær 4226 Multi-function calibrator	(AS-52)
HP 34401A Digital multimeter	(AS-66)
Rohde & Schwarz UPD Audio Analyzer	(AS-71)
MadgeTech PRHTemp2000	(AS-106)
PCB Piezotronics ICP signal conditioner	(VS-62-1)

Calibrated by  <b>R Nel</b> Metrologist (Technical Signatory)	Checked by  <b>CS Veldman</b> Metrologist	For Chief Executive Officer 
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## Conditions under which the NMISA will perform work

In this document, reference to a service or services will include: calibration, measurement, analysis or conformance work performed by NMISA on behalf of the Applicant.

1. The NMISA is empowered by the Measurement Unit and Measurement Standards Act, Act No. 18 of 2006.
2. Services are carried out at the discretion of the NMISA, which reserves the right to decline any application for performance of services when deemed to be outside the scope of services of the NMISA.
3. Through acceptance of the original quotation, the Applicant agrees to the quoted fee and the conditions stated herein. In cases where the NMISA has not published the amount of the fee, the NMISA will in good faith give estimates of the time and cost of the service based upon its previous experience.
4. Payment is strictly 30 days from the date of invoice; or as mutually agreed in writing between the Applicant and the NMISA before the service commenced. The NMISA retains the right to ask for a deposit for international services.
5. Regarding certificates and reports:
  - a. A certificate or report, as appropriate, will be furnished to the Applicant on completion of the service;
  - b. Reports or certificates may be freely published by the Applicant provided that such publication is verbatim and in full;
  - c. The NMISA reserves the right after the termination of a period of one year or any period agreed upon, to publish or report in whole or in part together with any comments or additional matter which is considered desirable but will not in general expect to exercise that right except as regards service results deemed to be of general interest;
  - d. Additional certified copies of certificates or reports, or re-issued certificates or reports will be subject to an additional fee, as determined on a case by case basis.
6. All gauges, instruments, items of equipment, etc. sent by the Applicant for performance of services at the NMISA shall be delivered and collected at the Applicant's own cost and risk.
7. The NMISA cannot guarantee to complete the work within the estimated time and cost but will consult the Applicant if it becomes apparent that either estimate will be exceeded.
8. If a service is not completed because of defects or deficiencies in the item submitted by the applicant, an appropriate reduction in the fee may be allowed depending on the amount of work already performed. The normal practice will be to charge the fee in full.
9. The Applicant hereby consents that the legal liability of the NMISA with regard to any damage whatsoever or a mistake made by the NMISA in services performed for the Applicant will be limited to the original quoted fee.

## VALIDITY OF CALIBRATION

The values in this certificate are correct at the time of the calibration. Subsequently the accuracy will depend on such factors as the care exercised in handling and use of the instrument and the frequency of its use. Recalibration should be performed after a period which has been chosen to ensure that the instrument's accuracy remains within the desired limits.

**2 RESULTS**

2.1 The sensitivities of the microphone preamplifier assembly were found to be:


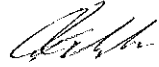

Nominal Frequency (Hz)	UUT Sensitivity (dB re 1 volt)	Uncertainty (dB)	Sensitivity* (mV/Pa)
125	-33,10 ①	0,10	22.13
250	-33,39 ②	0,10	21.40
500	-33,64 ③	0,10	20.80
1 000	-33,80 ④	0,10	20.42

\*  $1 \text{ V/Pa} = 10^{(UUT/20)}$   
 L. Riaan Nel (NMISA)  
 2011-10-07

**3 REMARKS**

- 3.1 The reported uncertainties of measurement were calculated and expressed in accordance with the BIPM, IEC, ISO, IUPAP, OIML document entitled "A Guide to the Expression of Uncertainty in Measurement" (International Organisation for Standardisation, Geneva, Switzerland, 1993).
- 3.2 The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by a coverage factor of k=2, which for a normal distribution approximates a level of confidence of 95,45%.
- 3.3 Certain of the NMISA certificates are consistent with the capabilities that are included in appendix C of the MRA (Mutual Recognition Arrangement) drawn up by the CIPM. Under the MRA, all participating institutes recognise the validity of each other's calibration and measurement certificates for the quantities and ranges and measurement uncertainties specified in Appendix C. For details see <http://www.bipm.org>.
- 3.4 The calibrations were carried out at an ambient temperature of 23 °C ± 2 °C and a relative humidity of 50 %RH ± 20 %RH.
- 3.5 Only parameters given in 2.1 were calibrated.
- 3.6 ①②③④ The measurement results for the UUT were not corrected to a reference static pressure and a reference temperature and no volume corrections were applied. The measurement results were valid for a static pressure of 86,5 kPa and a temperature of 24,2 °C

----- end of certificate -----

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