


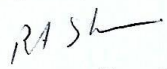




Appendix
15.1 Calibration
Certificates

	<p>MTS Calibration Ltd, The Grange Business Centre, Belasis Avenue, Billingham TS23 1LG, England Telephone: 01642 876 410</p>																																
		0607																															
CERTIFICATE OF CALIBRATION		Page 1 of 1																															
<p>Issued by: MTS Calibration Ltd Performed by: Tony Sherris Date of Issue: 14 March 2023</p>	<p>Certificate Number: 38216U</p>	<p>Approved Signatory:  Tony Sherris</p>																															
Sound Calibrator																																	
<p><i>Client:</i> Environmental Measurements Unit 12, Tallaght Business Centre Whitestown Business Park Co.Dublin 24, Ireland</p>																																	
<p><i>The Device calibrated was:</i> Larson Davis Model CA250 Serial Number 3034</p>																																	
<p><i>The measurements were performed at Elvington Close, Billingham, TS23 3YS and the measured values were as follows:</i></p> <table border="1" style="margin-left: auto; margin-right: auto; border-collapse: collapse;"> <tr> <td style="padding: 5px;">Output Level 1:</td> <td style="padding: 5px;">114.04 dB re 20μPa</td> <td style="padding: 5px;">± 0.16 dB (k= 2)</td> </tr> <tr> <td style="padding: 5px;">Fundamental Frequency 1:</td> <td style="padding: 5px;">248.20 Hz</td> <td style="padding: 5px;">± 0.11 Hz (k= 2)</td> </tr> <tr> <td style="padding: 5px;">Total Harmonic Distortion 1:</td> <td style="padding: 5px;">0.86 %</td> <td style="padding: 5px;">± 0.023 % (k= 2)</td> </tr> </table> <p style="font-size: small; margin-top: 5px;">This measurement is valid only for the above device configured for calibration of a WS-2 microphone under the stated environmental conditions. For deviation of prevailing conditions, the manufacturer's literature for the calibrator should be referred to.</p>				Output Level 1:	114.04 dB re 20μPa	± 0.16 dB (k= 2)	Fundamental Frequency 1:	248.20 Hz	± 0.11 Hz (k= 2)	Total Harmonic Distortion 1:	0.86 %	± 0.023 % (k= 2)																					
Output Level 1:	114.04 dB re 20μPa	± 0.16 dB (k= 2)																															
Fundamental Frequency 1:	248.20 Hz	± 0.11 Hz (k= 2)																															
Total Harmonic Distortion 1:	0.86 %	± 0.023 % (k= 2)																															
<p><i>Date of Measurements:</i> 14 March 2023</p>		<p><i>Date of Receipt:</i> 09 March 2023</p>																															
<p>Method of calibration</p> <p>A Reference Calibrator was used to establish the sensitivity of the measurement chain. The same measurement chain is then used to determine the output level of the Object Calibrator by the difference between its output and that of the nominated Reference Calibrator. Four independent measurements of the third-octave band sound pressure levels produced by the Reference Calibrators and the Object Calibrator are averaged to minimise uncertainties of the calibration. The measurement chain consists of a calibrated, Reference Microphone, Reference Preamplifier and Reference Analyser.</p> <p>As well as providing a traceable measurement of the sound pressure level in the cavity of the Object Calibrator, the Calibrator's frequency and total harmonic distortion are also measured. Frequency is determined from the average of four independent measurements using a multimeter. The total harmonic distortion is measured from the average of three independent measurements by third octave analysis, subtracting the level of the fundamental frequency from the sum of the combined harmonics in the frequency band to 20kHz. The complete procedure is detailed in the MTS Calibration Ltd work procedure WP01.</p> <p>The sound pressure level generated by the calibrator in its WS2 configuration was measured by reference to the reference Sound Calibrator as shown in the Test Equipment section below.</p> <p>The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor k (individually calculated as above), providing a coverage probability of approximately 95%. The uncertainty evaluation has been calculated in accordance with the current version of UKAS publication M3003. The uncertainty quoted for the Distortion Measurement is the Distortion Percentage as measured, multiplied by our Uncertainty as calculated for the individual measurement or our CMC, whichever is the larger.</p>																																	
<p>Measurement Conditions:</p> <table style="margin-left: auto; margin-right: auto;"> <tr> <td style="padding: 2px 10px;">Temperature</td> <td style="padding: 2px 10px;">23</td> <td style="padding: 2px 10px;">°C</td> <td style="padding: 2px 10px;">± 1 °C</td> </tr> <tr> <td style="padding: 2px 10px;">Atmospheric Pressure</td> <td style="padding: 2px 10px;">1000</td> <td style="padding: 2px 10px;">mBar</td> <td style="padding: 2px 10px;">± 2 mBar</td> </tr> <tr> <td style="padding: 2px 10px;">Relative Humidity</td> <td style="padding: 2px 10px;">33</td> <td style="padding: 2px 10px;">%</td> <td style="padding: 2px 10px;">± 5 %</td> </tr> </table>				Temperature	23	°C	± 1 °C	Atmospheric Pressure	1000	mBar	± 2 mBar	Relative Humidity	33	%	± 5 %																		
Temperature	23	°C	± 1 °C																														
Atmospheric Pressure	1000	mBar	± 2 mBar																														
Relative Humidity	33	%	± 5 %																														
<p>Test Equipment used during this calibration:</p> <table border="1" style="width: 100%; border-collapse: collapse; font-size: small;"> <thead> <tr> <th>Equipment</th> <th>Manufacturer</th> <th>Model</th> <th>Serial No.</th> <th>Traceability Ref.</th> <th>Calibration Due</th> </tr> </thead> <tbody> <tr> <td>Reference Calibrator</td> <td>Larson Davis</td> <td>CAL250</td> <td>4483</td> <td>TE 116</td> <td>Apr-25</td> </tr> <tr> <td>Multimeter</td> <td>HP</td> <td>34401A</td> <td>36146A63804</td> <td>TE 105</td> <td>Oct-23</td> </tr> <tr> <td>Microphone</td> <td>B&K</td> <td>4133</td> <td>810486</td> <td>TE 155</td> <td>Aug-23</td> </tr> <tr> <td>Real-Time Analyser (set 1)</td> <td>Larson Davis</td> <td>2900</td> <td>0492</td> <td>TE 108</td> <td>Jul-23</td> </tr> </tbody> </table>				Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Calibration Due	Reference Calibrator	Larson Davis	CAL250	4483	TE 116	Apr-25	Multimeter	HP	34401A	36146A63804	TE 105	Oct-23	Microphone	B&K	4133	810486	TE 155	Aug-23	Real-Time Analyser (set 1)	Larson Davis	2900	0492	TE 108	Jul-23
Equipment	Manufacturer	Model	Serial No.	Traceability Ref.	Calibration Due																												
Reference Calibrator	Larson Davis	CAL250	4483	TE 116	Apr-25																												
Multimeter	HP	34401A	36146A63804	TE 105	Oct-23																												
Microphone	B&K	4133	810486	TE 155	Aug-23																												
Real-Time Analyser (set 1)	Larson Davis	2900	0492	TE 108	Jul-23																												
<p>This certificate is issued in accordance with the laboratory accreditation requirements of the United Kingdom Accreditation Service. It provides traceability of measurement to the SI system of units and/or to units of measurement realised at the National Physical Laboratory or other recognised national metrology institutes. This certificate may not be reproduced other than in full, except with the prior written approval of the issuing laboratory.</p>																																	
End of Certificate																																	

Calibration Certificate

Certificate Number 2021012655

Customer:

Environmental Measurement
Unit 12 Tallaght Business Centre
Whitestown Business Park
Dublin, 24, Ireland

Model Number LxT SE

Serial Number 0006853

Test Results Pass

Initial Condition As Manufactured

Description Sound Expert LxT
Class 1 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378

Technician Ron Harris

Calibration Date 5 Oct 2021

Calibration Due

Temperature 23.67 °C ± 0.25 °C

Humidity 51 %RH ± 2.0 %RH

Static Pressure 86.34 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT1L S/N 070105 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 23.6 mV/Pa.

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8384:

IEC 60651:2001 Type 1	ANSI S1.4-2014 Class 1
IEC 60804:2000 Type 1	ANSI S1.4 (R2006) Type 1
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 1	ANSI S1.43 (R2007) Type 1
IEC 61260:2001 Class 1	ANSI S1.11 (R2009) Class 1

Issuing lab certifies that the instrument described above meets or exceeds all specifications as stated in the referenced procedure (unless otherwise noted). It has been calibrated using measurement standards traceable to the International System of Units (SI) through the National Institute of Standards and Technology (NIST), or other national measurement institutes, and meets the requirements of ISO/IEC 17025:2017. **Test points marked with a ‡ in the uncertainties column do not fall within this laboratory's scope of accreditation.**

The quality system is registered to ISO 9001:2015.

This calibration is a direct comparison of the unit under test to the listed reference standards and did not involve any sampling plans to complete. No allowance has been made for the instability of the test device due to use, time, etc. Such allowances would be made by the customer as needed.

The uncertainties were computed in accordance with the ISO Guide to the Expression of Uncertainty in Measurement (GUM). A coverage factor of approximately 2 sigma (k=2) has been applied to the standard uncertainty to express the expanded uncertainty at approximately 95% confidence level.

This report may not be reproduced, except in full, unless permission for the publication of an approved abstract is obtained in writing from the organization issuing this report.

Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert LxT, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

Calibration Check Frequency: 1000 Hz; Reference Sound Pressure Level: 114 dB re 20 µPa

LARSON DAVIS - A PCB PIEZOTRONICS DIV.
1681 West 820 North
Provo, UT 84601, United States
716-684-0001



LARSON DAVIS
A PCB DIVISION