

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Orifice Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Tisch Environmental, Inc.	TE-5025A 3383	Jiranatee Associates Co., Ltd.	CL-003-65	26 Jul 22	25 Jul 24	-
5	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503035	UAE Consultant Co., Ltd.	27042023	27 Apr 23	26 Apr 24	-
6	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503036	UAE Consultant Co., Ltd.	28022023	28 Feb 23	27 Feb 24	-
7	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503037	UAE Consultant Co., Ltd.	22022023	22 Feb 23	21 Feb 24	-
8	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1191503038	UAE Consultant Co., Ltd.	21042023	21 Apr 23	20 Apr 24	-
9	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497726	UAE Consultant Co., Ltd.	07042023	7 Apr 23	6 Apr 24	-
10	Nitrogen Dioxide Analyzer	Nitrogen Dioxide	Thermo Scientific	42i 1201497724	UAE Consultant Co., Ltd.	22022023	22 Feb 23	21 Feb 24	-
11	Standard Gases (Mixture)	Nitrogen Dioxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
12	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i CM08140003	UAE Consultant Co., Ltd.	18012023	18 Jan 23	17 Jan 24	-
13	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540068	UAE Consultant Co., Ltd.	21022023	21 Feb 23	20 Feb 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
14	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48i 1180540069	UAE Consultant Co.,Ltd.	14032023	14 Mar 23	13 Mar 24	-
15	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YN43AG7T	UAE Consultant Co.,Ltd.	14032023	14 Mar 23	13 Mar 24	-
16	Carbon Monoxide Analyzer	Carbon Monoxide	Horiba	APMA-370 YRLHTB7G	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
17	Carbon Monoxide Analyzer	Carbon Monoxide	Thermo	48C 48CTL-65506-348	UAE Consultant Co.,Ltd.	08022023	8 Feb 23	7 Feb 24	-
18	Standard Gases (Mixture)	Carbon Monoxide	Airgas	EB0143262 2015PSIG	Airgas an Air Liquide company	E04NI99E15A01D3	21 Jun 21	21 Jun 24	-
19	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	143/23	31 Mar 23	30 Mar 24	-
20	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	178/23	10 Apr 23	9 Apr 24	-
21	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Thai Meteorological Department	162/23	11 Apr 23	10 Apr 24	-
22	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0065	Thai Meteorological Department	177/23	10 Apr 23	9 Apr 24	-
23	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0072	Thai Meteorological Department	142/23	31 Mar 23	30 Mar 24	-
24	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0102	Thai Meteorological Department	161/23	11 Apr 23	10 Apr 24	-
25	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	Larson Davis	CAL150 6307	Innovative Instrument Co.,Ltd.	23-ACT-067	12 May 23	11 May 24	-
26	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{A90} , L_{Amax}	Larson Davis	LXT2 0006689	Larson Davis-A PCB Piezotronics Div.	2022003082	11 Mar 22	10 Mar 24	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
27	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{A90} , L_{Amax}	Larson Davis	LxT2 0006691	Larson Davis-A PCB Piezotronics Div.	2022003087	11 Mar 22	10 Mar 24	-
28	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{A90} , L_{Amax}	Larson Davis	LxT2 0006692	Larson Davis-A PCB Piezotronics Div.	2022003094	11 Mar 22	10 Mar 24	-
29	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{A90} , L_{Amax}	Larson Davis	LxT2 0006693	Larson Davis-A PCB Piezotronics Div.	2022002973	9 Mar 22	8 Mar 24	-
30	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{A90} , L_{Amax}	Larson Davis	LxT2 0006694	Larson Davis-A PCB Piezotronics Div.	2022003098	11 Mar 22	10 Mar 24	-
31	Sound Level Meter	$L_{Aeq\ 24\ hours}$, $L_{Aeq\ 1\ hour}$, L_{A90} , L_{Amax}	Larson Davis	LxT2 0006695	Larson Davis-A PCB Piezotronics Div.	2022003099	11 Mar 22	10 Mar 24	-



JIRANATEE ASSOCIATES CO.,LTD.

Jiranatee Associates Co.,Ltd
63/14-15, 67/35-36
Petchkasem 7,7/1, Rd. Watthapra, Bangkokyai,
Bangkok 10600 (Thailand)
Tel: +6608680812
Mobile: +66863999453
E-mail: jnac-calibration@jiranatee.com
Web site: www.jiranatee.com

Accredited calibration laboratory
ISO/IEC 17025:2017
NSC-TISI-TIS 17025
CALIBRATION 0367

Flow measurement laboratory
Calibration services department.

CERTIFICATE OF CALIBRATION

Certificate No. : CL-003-65

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : Tisch Environmental, Inc.
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 3383
ID NUMBER : UAE.EFM.063/2560
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 15 Jul 2022
MEASUREMENT DATE : 25 Jul 2022
ISSUE DATE : 26 Jul 2022

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follow:

Temperature	: 23.0 ± 3.0	°C
Relative Humidity	: 55.0 ± 15.0	%RH
Atmospheric Pressure	: 1010 ± 10	hPa

CALIBRATION CONDITION:

Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 24.8 °C and 55.1 %RH.

TABULATION OF RESULTS:

The table on next page give the measured values.

Calibration procedure:

The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roots Meter) Model G65/IMC/W2-dp. The WI-CL-004 was used as a calibration guideline.

Traceability:

This certificate provides a traceability of The measurement to recognized the national standards, and to realization of the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: G2211901

Uncertainty of Measurement:

The reported uncertainty of measurement is based on the standard uncertainty multiplied by a coverage factor $k=2$, Which for a normal distribution corresponds to a coverage probability of approximately 95%. The standard uncertainty has been determined in accordance with the GUM 'Evaluation of measurement data - Guide to the expression of uncertainty in measurement'

Calibrated by:

☐ Mr. Sorawit Thachalad
☒ Miss Jitraporn Lertsomphol



Approved signatory:

Mr. Parinya Booncharoen
Calibration Department Manager

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roots Meter). The Humid air was used as a medium in the system. The standard conditions are 25°C (298.15 K) and 760 mmHg for standard temperature and standard pressure respectively.

Table 1: The results of Q Standard calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.697	754.265	24.640	23.960	55.399	1.699	1.299	0.643
2	1.000	754.236	24.950	24.350	62.172	3.444	1.849	0.913
3	1.118	754.323	24.730	24.210	41.925	4.582	2.133	1.051
4	1.169	754.212	24.640	24.160	31.045	5.150	2.262	1.116
5	1.416	754.175	24.480	24.210	30.117	7.629	2.754	1.353

Slope (m): 2.04804
 Intercept (b): -0.01939
 Correlation coefficient (r): 0.99982
 Uncertainty ($k=2$): 0.011 m^3/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m^3/min	Pressure [Pa] mmHg	Temperature [Ta] °C	Temperature [Tm] °C	Δp_{meter} mmHg	$\Delta p_{Orifice}$ inH ₂ O	γ	Standard Flow [Q_s] m^3/min
1	0.697	754.265	24.640	23.960	55.399	1.699	0.819	0.647
2	1.000	754.236	24.950	24.350	62.172	3.444	1.167	0.919
3	1.118	754.323	24.730	24.210	41.925	4.582	1.345	1.058
4	1.169	754.212	24.640	24.160	31.045	5.150	1.426	1.123
5	1.416	754.175	24.480	24.210	30.117	7.629	1.735	1.361

Slope (m): 1.28277
 Intercept (b): -0.01223
 Correlation coefficient (r): 0.99982
 Uncertainty ($k = 2$): 0.012 m^3/min

End of Certificate of Calibration



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 18, 2023

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : CM08140003

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68
Nitric Oxide (NO)	45.94
Methane (CH ₄)	-
Carbon Monoxide (CO)	984.8
Cylinder No. :	EB0143262
Expiration Date :	Jun 20, 2024

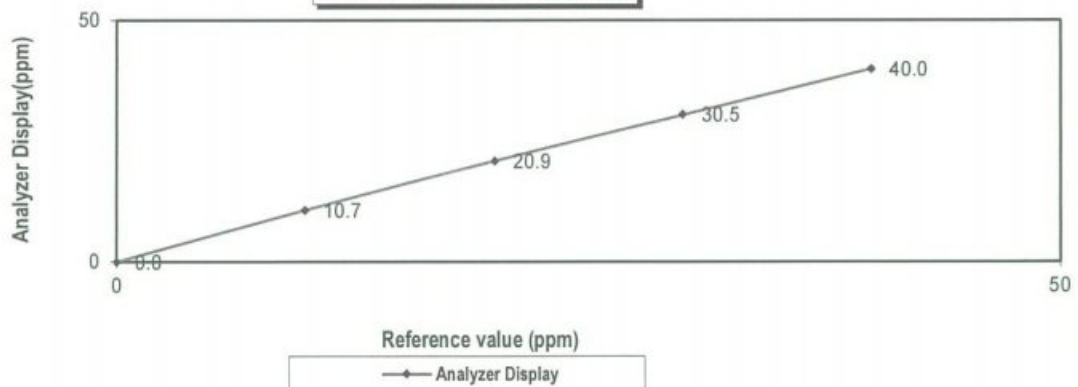
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.9	0.9	4.3	4.3
Level 4	60.00%	30.0	30.5	0.5	1.6	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.50
			:Acceptable Limit $\pm 5\%$			

Multi-Point Gas Test Chart



Calculate by

Aphivat

18 / 01 / 66

Approve by

Pabnom N.

19 / Jan / 2023



UNITED ANALYST AND ENGINEERING
CONSULTANT COMPANY LIMITED

United Analyst and Engineering Consultant Co., Ltd.

3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Tel. 0 2763 2828 Fax 0 2763 2800 www.uaec consultant.com E-mail: uae@uaec consultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Feb 21, 2023

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1180540068

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail

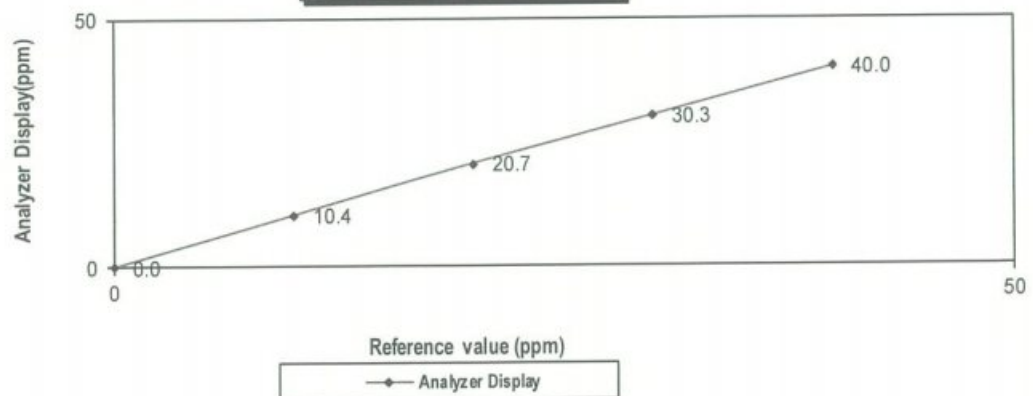
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.4	0.4	3.8	3.8
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
Level 4	60.00%	30.0	30.3	0.3	1.0	1.0
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range 50.0 ppm				Average Difference (%)		1.64

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



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Approve by

Patirun U.

22 / Feb / 2023



UNITED ANALYST AND ENGINEERING
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Tel. 0 2763 2828 Fax 0 2763 2800 www.uaec consultant.com E-mail: uae@uaec consultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Mar 14, 2023

Equipment : Gas Analyzer (CO)

Model : 48i

Manufacturer : Thermo Scientific

Serial Number : 1180540069

Standard Gas Concentration

Sulphur Dioxide (SO₂)

44.68

PPM

Nitric Oxide (NO)

45.94

PPM

Methane (CH₄)

-

PPM

Carbon Monoxide (CO)

984.8

PPM

Cylinder No. :

EB0143262

Expiration Date :

Jun 20, 2024

Dilutor Detail

Manufacturer :

Thermo Scientific

Model :

146i

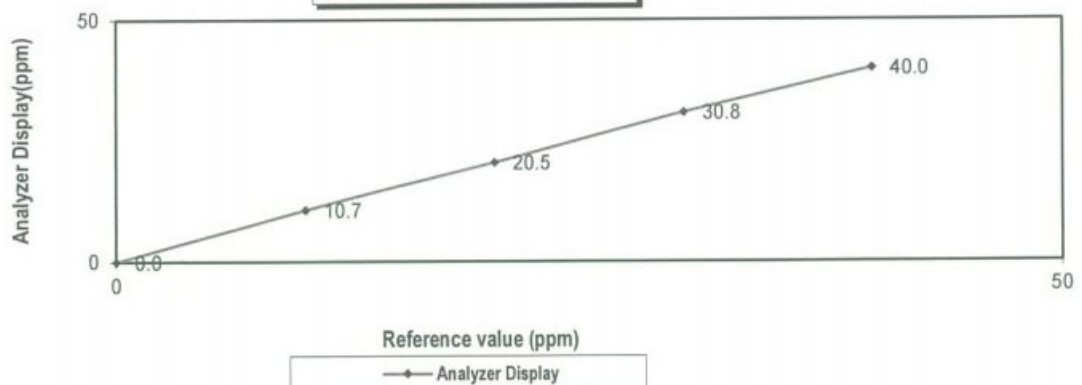
Serial Number :

1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.5	0.5	2.4	2.4
Level 4	60.00%	30.0	30.8	0.8	2.6	2.6
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.32

Multi-Point Gas Test Chart



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Pichorn U

14 / Mar / 2023



UNITED ANALYST AND ENGINEERING
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Tel. 0 2763 2828 Fax 0 2763 2800 www.uaec consultant.com E-mail: uae@uaec consultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Mar 14, 2023

Equipment : Gas Analyzer (CO)

Model : APMA-370

Manufacturer : HORIBA

Serial Number : YN43AG7T

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

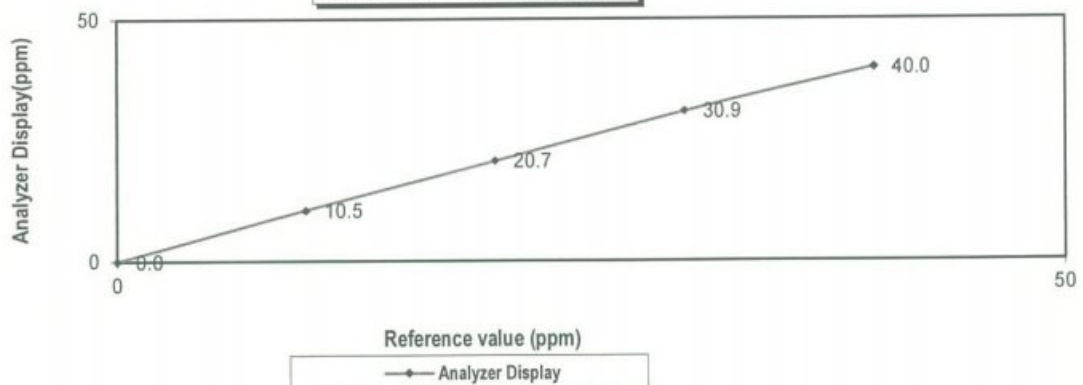
Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppm)			Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.5	0.5	4.8	4.8
Level 3	40.00%	20.0	20.7	0.7	3.4	3.4
Level 4	60.00%	30.0	30.9	0.9	2.9	2.9
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range			50.0 ppm	Average Difference (%)		2.21

Multi-Point Gas Test Chart



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Pattana

14 / Mar / 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

Equipment : Gas Analyzer (CO)

Model : APMA-370

Manufacturer : HORIBA

Serial Number : YRLHTB7G

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68
Nitric Oxide (NO)	45.94
Methane (CH ₄)	-
Carbon Monoxide (CO)	984.8
Cylinder No. :	EB0143262
Expiration Date :	Jun 20, 2024

Dilutor Detail

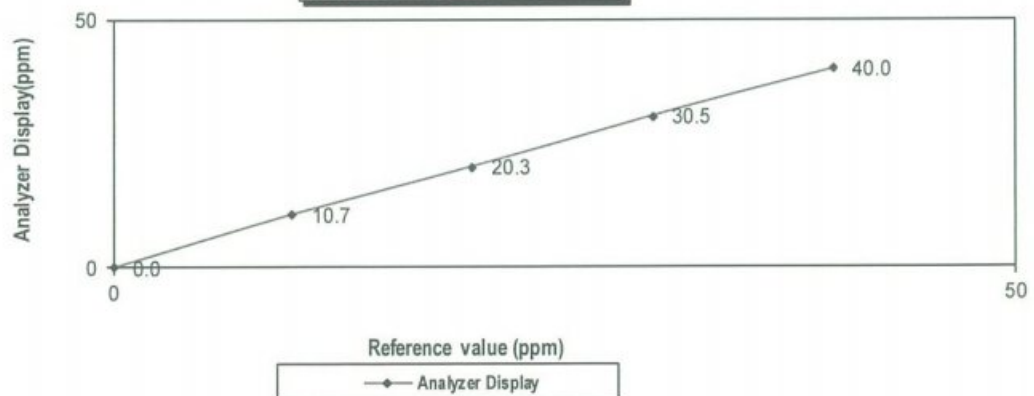
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.7	0.7	6.5	6.5
Level 3	40.00%	20.0	20.3	0.3	1.5	1.5
Level 4	60.00%	30.0	30.5	0.5	1.6	1.6
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range 50.0 ppm				Average Difference (%)		1.93

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



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Approve by

Petunorn

8 / Feb / 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 8, 2023

Equipment : Gas Analyzer (CO) **Model** : 48C
Manufacturer : Thermo Environmental Instruments **Serial Number** : 48C-65506-348

Standard Gas Concentration

Sulphur Dioxide (SO₂) 44.68
Nitric Oxide (NO) 45.94
Methane (CH₄) -
Carbon Monoxide (CO) 984.8
Cylinder No. : EB0143262
Expiration Date : Jun 20, 2024

Dilutor Detail

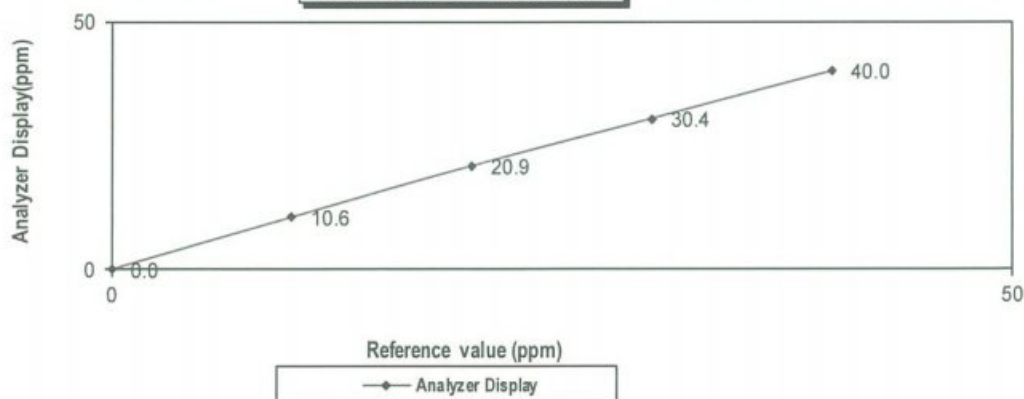
Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

	Reference Value (ppm)		Analyzer Display (ppm)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.0	0.0	0.0
Level 2	20.00%	10.0	10.6	0.6	5.7	5.7
Level 3	40.00%	20.0	20.9	0.9	4.3	4.3
Level 4	60.00%	30.0	30.4	0.4	1.3	1.3
Level 5	80.00%	40.0	40.0	0.0	0.0	0.0
Remark : Measuring Range 50.0 ppm			Average Difference (%)		2.26	

:Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



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Approve by

Patthorn W

8 / Feb / 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01D3	Reference Number:	122-402135167-1
Cylinder Number:	EB0143262	Cylinder Volume:	144.4 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	+/- 1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4,348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

[Signature]

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Apr 27, 2023

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1191503035

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM
Nitric Oxide (NO)	45.94	PPM
Methane (CH ₄)	-	PPM
Carbon Monoxide (CO)	984.8	
Cylinder No. :	EB0143262	
Expiration Date :	Jun 21, 2024	

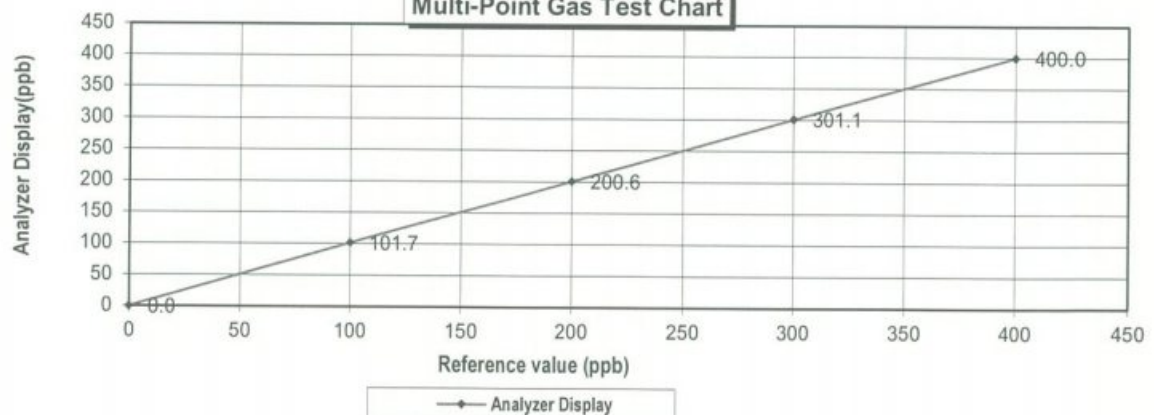
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.7	1.70	1.67	1.67
Level 3	40.00%	200.0	200.6	0.60	0.30	0.30
Level 4	60.00%	300.0	301.1	1.10	0.37	0.37
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb			Average Difference (%)		0.47	

Multi-Point Gas Test Chart



Calculate by

Aphiwat K.
27 / 4 / 66

Approve by

Adnan U.
27 / Apr, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 28, 2023

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1191503036

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68
Nitric Oxide (NO)	45.94
Methane (CH ₄)	-
Carbon Monoxide (CO)	984.8
Cylinder No. :	EB0143262
Expiration Date :	Jun 21, 2024

Dilutor Detail

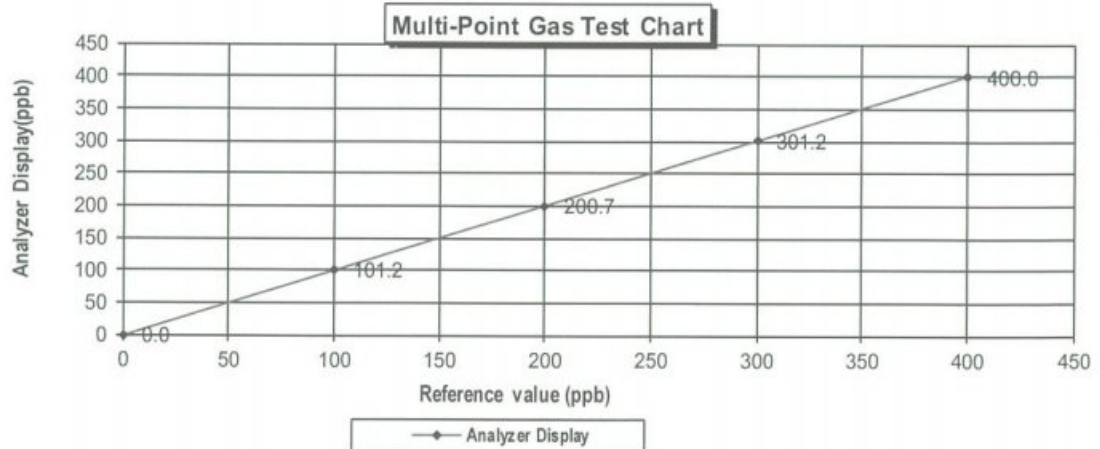
Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

Level	Reference Value (ppb)	Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.2	1.20	1.19
Level 3	40.00%	200.0	200.7	0.70	0.35
Level 4	60.00%	300.0	301.2	1.20	0.40
Level 5	80.00%	400.0	400.0	0.00	0.00

Remark : Measuring Range 500.0 ppb
:Acceptable Limit $\pm 5\%$

Average Difference (%) 0.39



Calculate by

Sirichai Gungai
28 / 2 / 66

Approve by

Patworn U
28 / Feb 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 22, 2023

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1191503037

Standard Gas Concentration

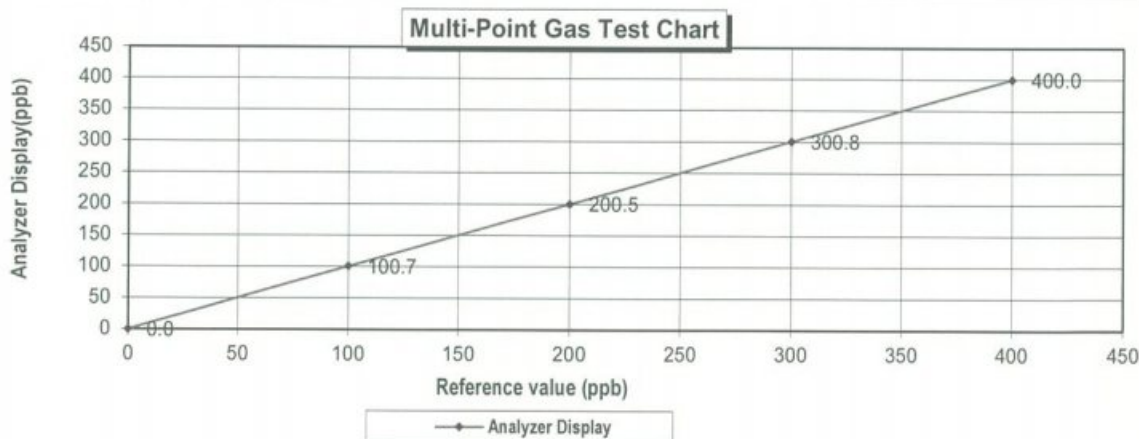
Sulphur Dioxide (SO₂) 44.68 PPM
Nitric Oxide (NO) 45.94 PPM
Methane (CH₄) - PPM
Carbon Monoxide (CO) 984.8 PPM
Cylinder No. : EB0143262
Expiration Date : Jun 21, 2024

Dilutor Detail

Manufacturer : Thermo Scientific
Model : 146i
Serial Number : 1180540071

Multi-point gas test data

Reference Value (ppb)			Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.7	0.70	0.70	0.70
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	300.8	0.80	0.27	0.27
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.24



Calculate by

Sirichai Gannepu
22 / 2 / 66

Approve by

Pattinorn U.
22 Feb, 2023

MULTI-POINT GAS TEST REPORT

Test Date : Apr 21, 2023

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1191503038

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68
Nitric Oxide (NO)	45.94
Methane (CH ₄)	-
Carbon Monoxide (CO)	984.8
Cylinder No. :	EB0143262
Expiration Date :	Jun 21, 2024

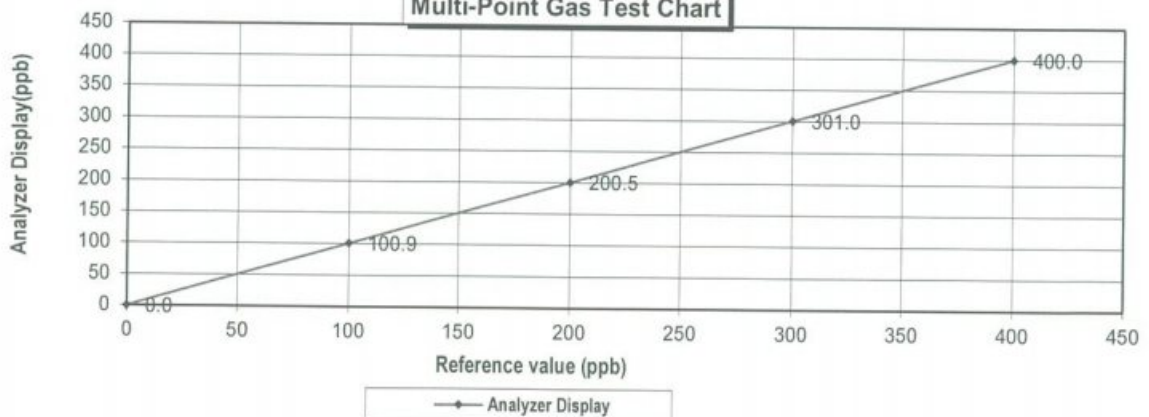
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	100.9	0.90	0.89	0.89
Level 3	40.00%	200.0	200.5	0.50	0.25	0.25
Level 4	60.00%	300.0	301.0	1.00	0.33	0.33
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range			500.0 ppb	Average Difference (%)		0.29
:Acceptable Limit $\pm 5\%$						

Multi-Point Gas Test Chart



Calculate by

Aphiwat K.
21 / 4 / 66

Approve by

Patiporn U.
21 / Apr / 2023

MULTI-POINT GAS TEST REPORT

Test Date : Apr 7, 2023

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201497726

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68
Nitric Oxide (NO)	45.94
Methane (CH ₄)	-
Carbon Monoxide (CO)	984.8
Cylinder No. :	EB0143262
Expiration Date :	Jun 21, 2024

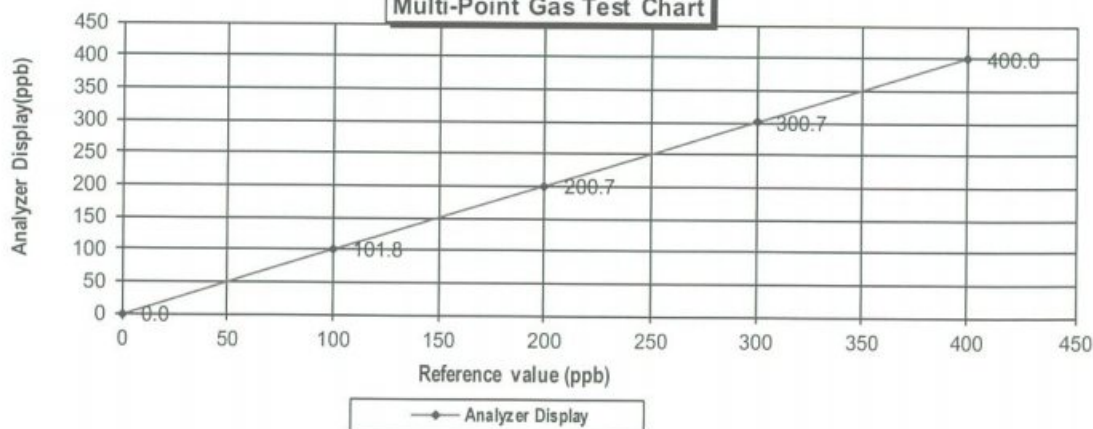
Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.8	1.80	1.77	1.77
Level 3	40.00%	200.0	200.7	0.70	0.35	0.35
Level 4	60.00%	300.0	300.7	0.70	0.23	0.23
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.47
:Acceptable Limit $\pm 5\%$						

Multi-Point Gas Test Chart



Calculate by

Aphiwat K.
7 / 4 / 66

Approve by

Patihom U
7 / Apr / 2023

MULTI-POINT GAS TEST REPORT

Test Date : Feb 22, 2023

Equipment : Gas Analyzer (NO₂)

Model : 42i

Manufacturer : Thermo Scientific

Serial Number : 1201497724

Standard Gas Concentration

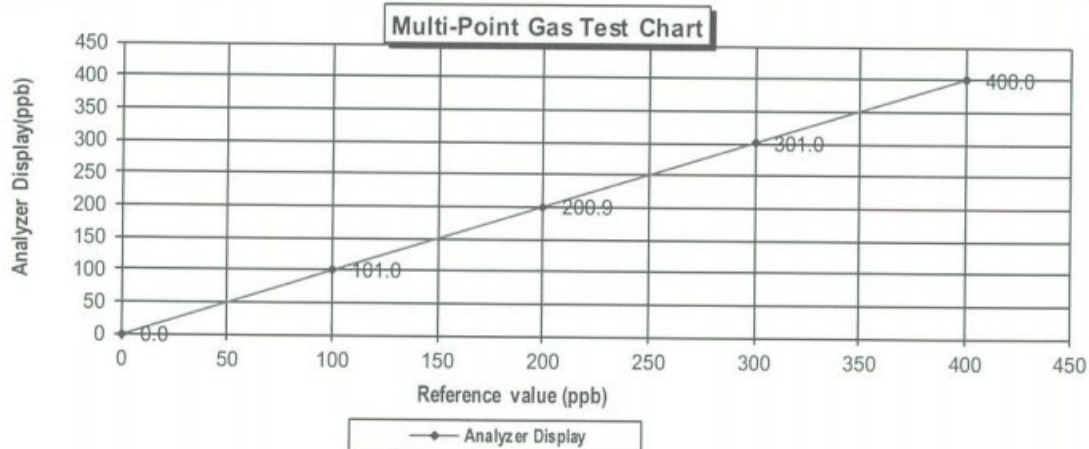
Sulphur Dioxide (SO ₂)	44.68
Nitric Oxide (NO)	45.94
Methane (CH ₄)	-
Carbon Monoxide (CO)	984.8
Cylinder No. :	EB0143262
Expiration Date :	Jun 21, 2024

Dilutor Detail

Manufacturer :	Thermo Scientific
Model :	146i
Serial Number :	1180540071

Multi-point gas test data

	Reference Value (ppb)		Analyzer Display (ppb)	Difference Error	Percent Error	[% Error]
Level 1	Zero	0.0	0.0	0.00	0.00	0.00
Level 2	20.00%	100.0	101.0	1.00	0.99	0.99
Level 3	40.00%	200.0	200.9	0.90	0.45	0.45
Level 4	60.00%	300.0	301.0	1.00	0.33	0.33
Level 5	80.00%	400.0	400.0	0.00	0.00	0.00
Remark : Measuring Range 500.0 ppb				Average Difference (%)		0.35
:Acceptable Limit $\pm 5\%$						



Calculate by

Sirichai Gamman
22, 2 / 66

Approve by

Pokinorn V
22, Feb, 2023

CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number:	E04NI99E15A01D3	Reference Number:	122-402135167-1
Cylinder Number:	EB0143262	Cylinder Volume:	144.4 CF
Laboratory:	124 - Durham (SAP) - NC	Cylinder Pressure:	2015 PSIG
PGVP Number:	B22021	Valve Outlet:	660
Gas Code:	CO,NO,NOX,SO2,BALN	Certification Date:	Jun 21, 2021

Expiration Date: Jun 21, 2024

Certification performed in accordance with "EPA Traceability Protocol for Assay and Certification of Gaseous Calibration Standards (May 2012)" document EPA 600/R-12/531, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty as stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration mixture. All concentrations are on a mole/mole basis unless otherwise noted.

Do Not Use This Cylinder below 100 psig, i.e. 0.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	06/14/2021, 06/21/2021
SULFUR DIOXIDE	45.00 PPM	44.68 PPM	G1	+/- 1.0% NIST Traceable	06/14/2021, 06/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	06/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS					
Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20061120	CC708068	49.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.0%	Feb 02, 2025
PRM	12386	D685025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%	Feb 20, 2020
GMIS	401423838102	CC505581	4,348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Feb 18, 2023
NTRM	16011043	CC473277	49.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Jun 17, 2022
NTRM	14060119	CC434277	990.9 PPM CARBON MONOXIDE/NITROGEN	+/-0.6%	Nov 15, 2025

The SRM, PRM or RGM noted above is only in reference to the GMIS used in the assay and not part of the analysis.

ANALYTICAL EQUIPMENT		
Instrument/Make/Model	Analytical Principle	Last Multipoint Calibration
Nicolet 6700 AHR0801333 CO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 NO2	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO2	FTIR	Jun 03, 2021

Triad Data Available Upon Request

NOTES: PO #5221002807

GROSS WT: 28.40kg

NET WT: 4.73kg



The analytical test results reported on this certificate relate only to the cylinder number specified above. This concludes the test report.

[Signature]

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 March, 2023

Certification No. 143/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0041

WIND SENSOR : 2111DT0041

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1009.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pisood Promsut



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1014.29	1014	0.29
1014.02	1014	0.02
1011.47	1012	-0.53
1011.25	1011	0.25
1011.11	1011	0.11
1011.38	1012	-0.62
1011.71	1012	-0.29
1013.48	1014	-0.52
1013.81	1014	-0.19
1014.02	1014	0.02
1013.73	1013	0.73
1013.32	1013	0.32
1014.92	1015	-0.08
1014.75	1015	-0.25
1014.38	1014	0.38
1014.21	1014	0.21
1013.57	1013	0.57
1013.01	1013	0.01
1011.26	1011	0.26
1011.59	1012	-0.41

Average

0.01

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
760.78	761	-0.22
760.58	761	-0.42
758.66	759	-0.34
758.50	758	0.50
758.39	758	0.39
758.60	759	-0.40
758.84	759	-0.16
760.17	760	0.17
760.42	760	0.42
760.58	761	-0.42
760.36	760	0.36
760.05	760	0.05
761.25	761	0.25
761.12	761	0.12
760.85	761	-0.15
760.72	761	-0.28
760.24	760	0.24
759.82	760	-0.18
758.51	759	-0.49
758.75	759	-0.25

Average

-0.04

Calibrated by :

Wolapap

Mr. Watcharapol Subwat

Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 143/23

31 March, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.24	45.4	-0.16
32.16	32.3	-0.14
16.48	16.5	-0.02

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 April, 2023

Certification No. 178/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0052

WIND SENSOR : 2111DT0052

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1006.9 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer

Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Signed :

Mr. Pisood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1013.17	1013	0.17
1013.43	1014	-0.57
1014.15	1014	0.15
1014.22	1014	0.22
1009.63	1009	0.63
1009.71	1010	-0.29
1009.95	1010	-0.05
1010.31	1010	0.31
1010.72	1011	-0.28
1010.80	1011	-0.20
1011.47	1011	0.47
1011.21	1011	0.21
1011.33	1011	0.33
1011.59	1012	-0.41
1011.89	1012	-0.11
1012.40	1012	0.40
1008.64	1009	-0.36
1008.80	1009	-0.20
1009.25	1009	0.25
1009.45	1009	0.45

Average

0.06

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
759.94	760	-0.06
760.13	760	0.13
760.67	761	-0.33
760.73	761	-0.27
757.28	757	0.28
757.34	757	0.34
757.52	758	-0.48
757.79	758	-0.21
758.10	758	0.10
758.16	758	0.16
758.66	759	-0.34
758.47	758	0.47
758.56	758	0.56
758.75	759	-0.25
758.98	759	-0.02
759.36	759	0.36
756.54	757	-0.46
756.66	757	-0.34
757.00	757	0.00
757.15	757	0.15

Average

0.04

Calibrated by :

Watchapol Subwat

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 178/23

10 April, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.15	45.3	-0.15
31.05	31.1	-0.05
15.32	15.5	-0.18

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 11 April, 2023

Certification No. 162/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2111DR0058

WIND SENSOR : 2111DT0058

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.7 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer

Model DA-650-3TV

(sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Signed :

Mr. Watcharapol Subwat

Mr. Pisood Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mbar)	Pressure (mbar)	(mbar)
1010.39	1010	0.39
1011.13	1011	0.13
1011.31	1011	0.31
1011.57	1011	0.57
1008.42	1009	-0.58
1008.86	1009	-0.14
1008.99	1009	-0.01
1009.36	1009	0.36
1009.94	1010	-0.06
1010.36	1010	0.36
1009.53	1010	-0.47
1009.85	1010	-0.15
1010.06	1010	0.06
1010.23	1010	0.23
1009.06	1009	0.06
1009.21	1009	0.21
1009.71	1010	-0.29
1010.32	1010	0.32
1011.21	1011	0.21
1011.50	1011	0.50

Average

0.10

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mmHg)	Pressure (mmHg)	(mmHg)
757.85	758	-0.15
758.41	758	0.41
758.54	758	0.54
758.74	759	-0.26
756.38	756	0.38
756.71	756	0.71
756.80	757	-0.20
757.08	757	0.08
757.52	757	0.52
757.83	758	-0.17
757.21	757	0.21
757.45	758	-0.55
757.61	758	-0.39
757.73	758	-0.27
756.86	757	-0.14
756.97	757	-0.03
757.34	757	0.34
757.80	758	-0.20
758.47	759	-0.53
758.69	759	-0.31

Average

0.00

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 162/23

11 April, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45.1	0.02
31.24	31.3	-0.06
15.82	15.9	-0.08

Calibrated by :

Watchapol

Mr. Watchapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 10 April, 2023

Certification No. 177/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2112DR0065

WIND SENSOR : 2112DT0065

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1007.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer

Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

STANDARD THERMOMETER

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Watcharapol Subwat

Signed :

Pisod Promsut

Mr. Watcharapol Subwat

Mr. Pisod Promsut

Mechanical Engineer

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	4.9	0.10
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.1	-0.09
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1013.17	1013	0.17
1013.43	1014	-0.57
1014.15	1014	0.15
1014.22	1014	0.22
1009.63	1010	-0.37
1009.71	1010	-0.29
1009.95	1010	-0.05
1010.31	1010	0.31
1010.72	1011	-0.28
1010.80	1011	-0.20
1011.47	1011	0.47
1011.21	1011	0.21
1011.33	1011	0.33
1011.59	1011	0.59
1011.89	1012	-0.11
1012.40	1012	0.40
1008.64	1009	-0.36
1008.80	1009	-0.20
1009.25	1009	0.25
1009.45	1010	-0.55

Average

0.01

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
759.94	760	-0.06
760.13	760	0.13
760.67	761	-0.33
760.73	761	-0.27
757.28	757	0.28
757.34	757	0.34
757.52	758	-0.48
757.79	758	-0.21
758.10	758	0.10
758.16	758	0.16
758.66	759	-0.34
758.47	759	-0.53
758.56	759	-0.44
758.75	759	-0.25
758.98	759	-0.02
759.36	759	0.36
756.54	756	0.54
756.66	757	-0.34
757.00	757	0.00
757.15	757	0.15

Average

0.06

Calibrated by :

Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



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THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 177/23

10 April, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.15	45.2	-0.05
31.05	31.0	0.05
15.32	15.4	-0.08

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 31 March, 2023

Certification No. 142/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21
WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2112DR0072
WIND SENSOR : 2112DT0072

Customer : United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.2 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 : Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Ultrasonic Anemometer Model DA-650-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

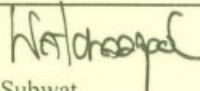
JAPAN QUALITY ASSURANCE ORGANIZATION

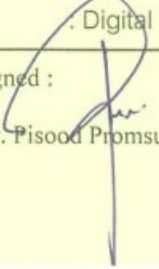
STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by : 
Mr. Watcharapol Subwat
Mechanical Engineer

Signed : 
Mr. Pisood Promsut

(Authorised Signatory)
for the Chief
Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 142/23

31 March, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacumm	Velocity	Velocity	Correction
	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	6.9	0.14
9.02	-	-	-	9.1	-0.08
11.02	-	-	-	10.9	0.12
13.01	-	-	-	12.9	0.11
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.1	-0.08

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 142/23

31 March, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
1014.29	1014	0.29
1014.02	1014	0.02
1011.47	1011	0.47
1011.25	1011	0.25
1011.11	1011	0.11
1011.38	1011	0.38
1011.71	1012	-0.29
1013.48	1013	0.48
1013.81	1014	-0.19
1014.02	1014	0.02
1013.73	1014	-0.27
1013.32	1013	0.32
1014.92	1015	-0.08
1014.75	1015	-0.25
1014.38	1014	0.38
1014.21	1014	0.21
1013.57	1013	0.57
1013.01	1013	0.01
1011.26	1011	0.26
1011.59	1012	-0.41

Average

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 142/23

31 March, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	
760.78	761	-0.22
760.58	760	0.58
758.66	759	-0.34
758.50	759	-0.50
758.39	758	0.39
758.60	759	-0.40
758.84	759	-0.16
760.17	760	0.17
760.42	760	0.42
760.58	761	-0.42
760.36	760	0.36
760.05	760	0.05
761.25	761	0.25
761.12	761	0.12
760.85	761	-0.15
760.72	761	-0.28
760.24	760	0.24
759.82	760	-0.18
758.51	758	0.51
758.75	759	-0.25

Average

0.01

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 142/23

31 March, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.24	45.5	-0.26
32.16	32.3	-0.14
16.48	16.5	-0.02

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue 11 April, 2023

Certification No. 161/23

Page : 1 of 5

Object : WIRELESS ANEMOMETER

Manufacturer : SCARLET

Type : WIRELESS RECEIVER : WL-21

WIND SENSOR : WL-21

Mfg Code : WIRELESS RECEIVER : 2112DR0102

WIND SENSOR : 2112DT0102

Customer : United Analyst and Engineering Consultant Co.,Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature 25.1 °C Barometric Pressure 1008.5 hPa

NATIONAL STANDARD WIND TUNNEL : Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425

: Wind Aloft Plotting Board

N.I.S.T. Test Reference Number 731/241460

: Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer

Model DA-650-3TV

(sensor TR-90AH)

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

: Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER

: Theodor Friedrich : Dry No.8390/94 Wet No. 8389/94

: testo, testo 645 Serial No. 02848057

: Thermoschneider No.918802

STANDARD BAROMETER

: Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB330 No. K4320001

Calibrated by :

Watchapol Subwat

Signed :

Pisood Promsut
Mr. Pisood Promsut

(Authorised Signatory)

for the Chief

Sub-Standard Instrument

Mr. Watchapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804,0-2399-0469

The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 2 of 5

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches H2O	Vacumm inches H2O	Velocity m/sec	Velocity m/sec	Correction m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	10.9	0.12
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Aloft Plotting Board.	
US.DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRETION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Wolachapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mbar)	Pressure (mbar)	(mbar)
1010.39	1010	0.39
1011.13	1011	0.13
1011.31	1011	0.31
1011.57	1012	-0.43
1008.42	1008	0.42
1008.86	1009	-0.14
1008.99	1009	-0.01
1009.36	1009	0.36
1009.94	1010	-0.06
1010.36	1010	0.36
1009.53	1009	0.53
1009.85	1010	-0.15
1010.06	1010	0.06
1010.23	1010	0.23
1009.06	1009	0.06
1009.21	1009	0.21
1009.71	1010	-0.29
1010.32	1010	0.32
1011.21	1011	0.21
1011.50	1012	-0.50

Average

0.10

Calibrated by :

Watcharapol Subwat

Mr. Watcharapol Subwat

Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure (mmHg)	Pressure (mmHg)	(mmHg)
757.85	758	-0.15
758.41	758	0.41
758.54	759	-0.46
758.74	759	-0.26
756.38	756	0.38
756.71	757	-0.29
756.80	757	-0.20
757.08	757	0.08
757.52	758	-0.48
757.83	758	-0.17
757.21	757	0.21
757.45	757	0.45
757.61	758	-0.39
757.73	758	-0.27
756.86	757	-0.14
756.97	757	-0.03
757.34	757	0.34
757.80	758	-0.20
758.47	758	0.47
758.69	759	-0.31

Average

0.05

Calibrated by :

Watchapol

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

4353 Sukhumvit, Bangna, Bangkok 10260 Tel. 081-454-2804, 0-2399-0469

The Result of Calibration

Certification No. 161/23

11 April, 2023

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.12	45.1	0.02
31.24	31.4	-0.16
15.82	16.0	-0.18

Calibrated by :

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม

Calibration Certificate

Certificate Number 2022003082

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006689
Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 11 Mar 2022
Calibration Due
Temperature 23.63 °C ± 0.25 °C
Humidity 53.5 %RH ± 2.0 %RH
Static Pressure 87.16 kPa ± 0.13 kPa

Evaluation Method Tested with: Data reported in dB re 20 µPa.

PCB 375A04. S/N 335074
Larson Davis CAL291. S/N 0108
Larson Davis CAL200. S/N 9079
Larson Davis PRMLxT2C. S/N 071570

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.11 (R2009) Class 2
IEC 61260:2001 Class 2	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2

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.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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Certificate Number 2022003082

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2021-09-10	2022-09-10	001250
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
Larson Davis CAL200 Acoustic Calibrator	2021-07-21	2022-07-21	007027
Larson Davis Model 831	2022-02-21	2023-02-21	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2022-03-02	2023-03-02	007185
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635
Larson Davis 1/2" Preamplifier for Model 831 Type I	2021-09-28	2022-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.78	-52.44	-48.33	0.14	Pass

-- End of measurement results--

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D0001.8406 Rev F

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.24	-0.20	-1.70	1.30	0.23	Pass
1000	0.14	0.00	-1.00	1.00	0.23	Pass
8000	-2.43	-3.00	-8.00	2.00	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	41.00

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002977

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road, Bangchak, Phra
Khanong, Bangkok, 10260, Thailand

Model Number	LxT2	Procedure Number	D0001.8378
Serial Number	0006689	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	9 Mar 2022
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 2 Class 2 Sound Level Meter Firmware Revision: 2.404	Temperature	23.97 °C ± 0.25 °C
		Humidity	51.1 %RH ± 2.0 %RH
		Static Pressure	85.4 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071570 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 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 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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.

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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

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D0001.8407 Rev F

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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635

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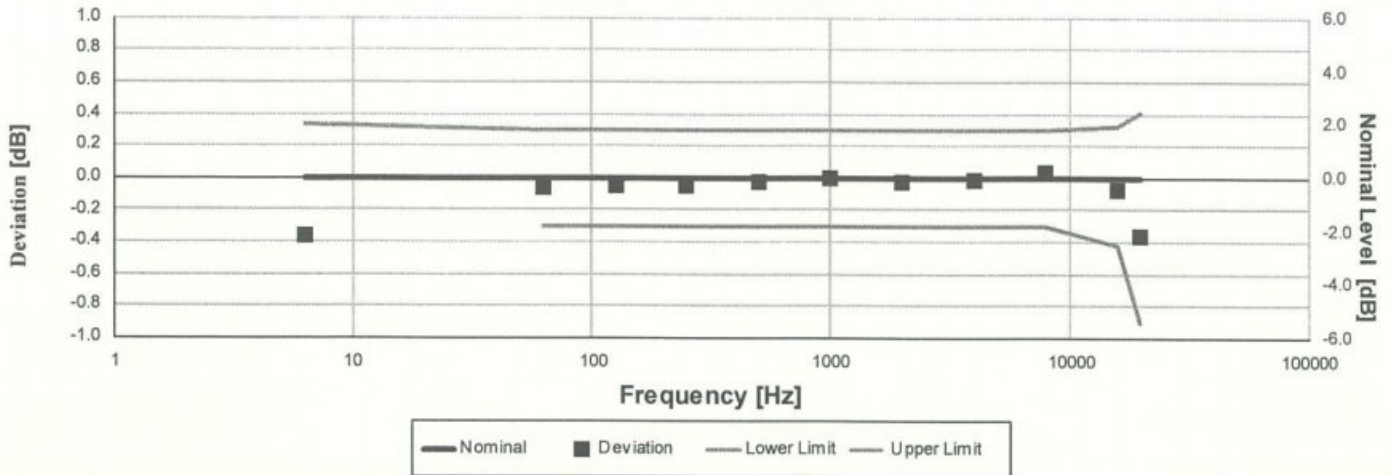
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Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.37	-0.37	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-0.03	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.36	-0.36	-0.91	0.41	0.15	Pass

-- End of measurement results--

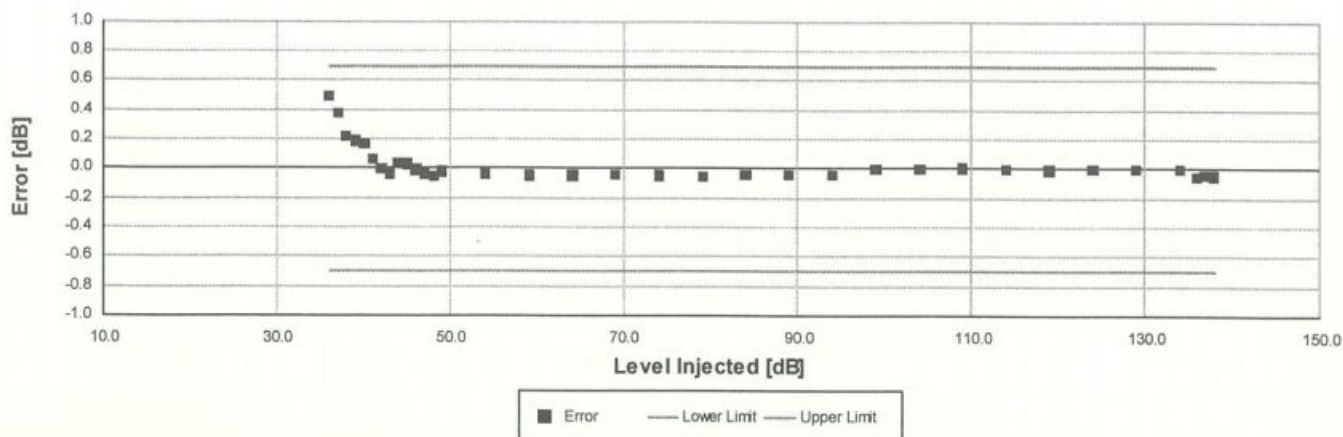
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A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.50	-0.70	0.70	0.16	Pass
37.00	0.38	-0.70	0.70	0.16	Pass
38.00	0.22	-0.70	0.70	0.16	Pass
39.00	0.19	-0.70	0.70	0.16	Pass
40.00	0.17	-0.70	0.70	0.16	Pass
41.00	0.06	-0.70	0.70	0.16	Pass
42.00	0.00	-0.70	0.70	0.16	Pass
43.00	-0.04	-0.70	0.70	0.16	Pass
44.00	0.04	-0.70	0.70	0.17	Pass
45.00	0.03	-0.70	0.70	0.16	Pass
46.00	-0.01	-0.70	0.70	0.16	Pass
47.00	-0.03	-0.70	0.70	0.16	Pass
48.00	-0.05	-0.70	0.70	0.16	Pass
49.00	-0.02	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.00	-0.70	0.70	0.15	Pass
104.00	0.00	-0.70	0.70	0.15	Pass
109.00	0.00	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	-0.01	-0.70	0.70	0.15	Pass
124.00	0.00	-0.70	0.70	0.15	Pass
129.00	0.00	-0.70	0.70	0.15	Pass
134.00	0.00	-0.70	0.70	0.15	Pass
136.00	-0.05	-0.70	0.70	0.15	Pass
137.00	-0.04	-0.70	0.70	0.15	Pass
138.00	-0.04	-0.70	0.70	0.15	Pass

-- End of measurement results--

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	135.14	133.71	135.71	0.15	Pass
		Positive Pulse	135.14	133.70	135.70	0.15	Pass
	30	Negative Pulse	134.20	133.71	135.71	0.15	Pass
		Positive Pulse	134.17	133.70	135.70	0.15	Pass

-- End of measurement results--

Positive Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.18	± 1.00	0.15 ‡	Pass
	5	-0.18	± 1.00	0.16 ‡	Pass
115.95	3	-0.22	± 1.00	0.15 ‡	Pass
	5	-0.16	± 1.00	0.15 ‡	Pass
105.95	3	-0.19	± 1.00	0.15 ‡	Pass
	5	-0.16	± 1.00	0.15 ‡	Pass

-- End of measurement results--

Negative Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.17	± 1.00	0.15 ‡	Pass
	5	-0.15	± 1.00	0.15 ‡	Pass
115.95	3	-0.19	± 1.00	0.15 ‡	Pass
	5	-0.16	± 1.00	0.15 ‡	Pass
105.95	3	-0.19	± 1.00	0.15 ‡	Pass
	5	-0.16	± 1.00	0.15 ‡	Pass

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.86	93.78	93.98	0.15	Pass
0 dB Gain, Linearity	40.31	39.28	40.68	0.16	Pass
OBA Low Range	93.90	93.78	93.98	0.15	Pass
OBA Normal Range	93.88	93.20	94.80	0.15	Pass

-- End of measurement results--

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.11	36.00	Pass
C-weight Noise Floor	27.00	35.00	Pass
Z-weight Noise Floor	32.93	39.00	Pass

-- End of measurement results--

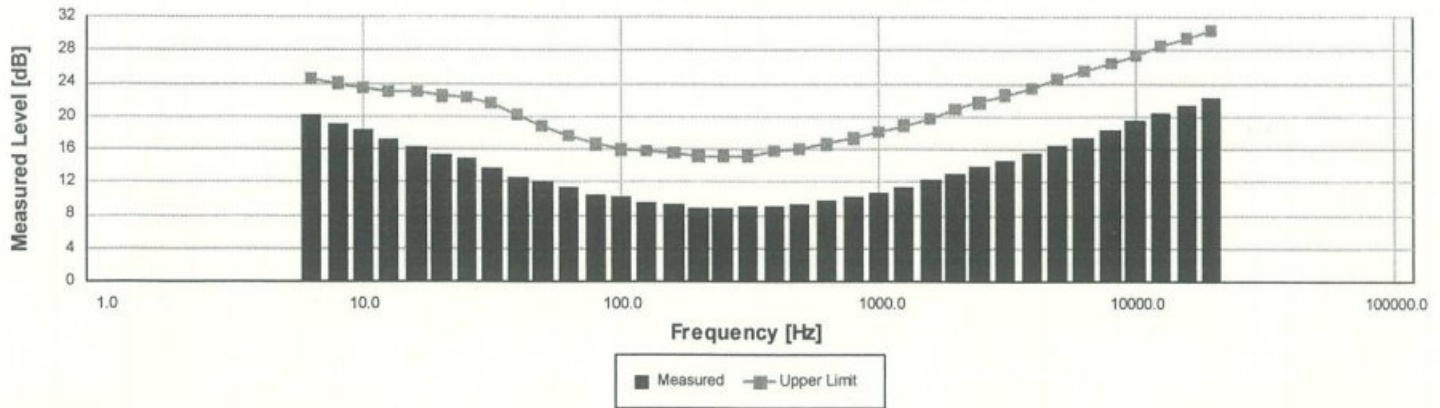
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.72	134.15	135.75	0.15	Pass
THD	-67.19		-58.00	0.00 ‡	Pass
THD+N	-63.08		-58.00	0.00 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.13	24.60	Pass
8.00	19.06	24.00	Pass
10.00	18.35	23.50	Pass
12.50	17.22	23.00	Pass
16.00	16.30	22.90	Pass
20.00	15.31	22.40	Pass
25.00	14.86	22.30	Pass
31.50	13.72	21.50	Pass
40.00	12.58	20.20	Pass
50.00	12.09	18.80	Pass
63.00	11.28	17.60	Pass
80.00	10.56	16.60	Pass
100.00	10.19	15.90	Pass
125.00	9.44	15.70	Pass
160.00	9.26	15.50	Pass
200.00	8.90	15.20	Pass
250.00	8.76	15.20	Pass
315.00	8.96	15.20	Pass
400.00	9.07	15.70	Pass
500.00	9.39	16.00	Pass
630.00	9.74	16.60	Pass
800.00	10.23	17.30	Pass
1,000.00	10.78	18.10	Pass
1,250.00	11.46	18.90	Pass
1,600.00	12.20	19.80	Pass
2,000.00	12.96	20.80	Pass
2,500.00	13.83	21.70	Pass
3,150.00	14.67	22.60	Pass
4,000.00	15.58	23.50	Pass
5,000.00	16.50	24.50	Pass
6,300.00	17.43	25.50	Pass
8,000.00	18.44	26.50	Pass
10,000.00	19.39	27.40	Pass
12,500.00	20.41	28.50	Pass
16,000.00	21.41	29.50	Pass
20,000.00	22.37	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022003087

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006691
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 11 Mar 2022
Calibration Due
Temperature 23.67 °C ± 0.25 °C
Humidity 52.4 %RH ± 2.0 %RH
Static Pressure 87.17 kPa ± 0.13 kPa

Evaluation Method **Tested with:** **Data reported in dB re 20 µPa.**
PCB 375A04. S/N 335075
Larson Davis CAL291. S/N 0108
Larson Davis CAL200. S/N 9079
Larson Davis PRMLxT2C. S/N 071560

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.11 (R2009) Class 2
IEC 61260:2001 Class 2	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2

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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.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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Certificate Number 2022003087

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2021-09-10	2022-09-10	001250
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
Larson Davis CAL200 Acoustic Calibrator	2021-07-21	2022-07-21	007027
Larson Davis Model 831	2022-02-21	2023-02-21	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2022-03-02	2023-03-02	007185
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635
Larson Davis 1/2" Preamplifier for Model 831 Type I	2021-09-28	2022-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.54	-52.44	-48.33	0.14	Pass

-- End of measurement results--

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.24	-0.20	-1.70	1.30	0.23	Pass
1000	0.17	0.00	-1.00	1.00	0.23	Pass
8000	-2.35	-3.00	-8.00	2.00	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.82

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002970

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road, Bangchak, Phra
Khanong, Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006691
Test Results **Pass**
Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 9 Mar 2022
Calibration Due
Temperature 24 °C ± 0.25 °C
Humidity 51.7 %RH ± 2.0 %RH
Static Pressure 85.34 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071560 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 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 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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.

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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

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D0001.8407 Rev F

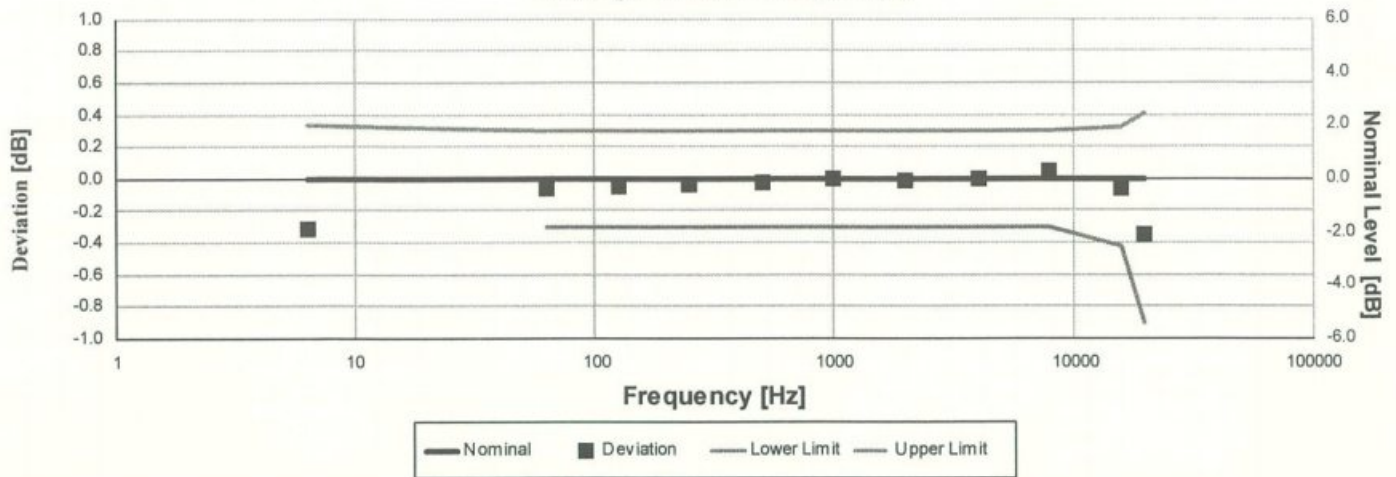
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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2022-01-03	2023-01-03	007118

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Z-weight Filter Response

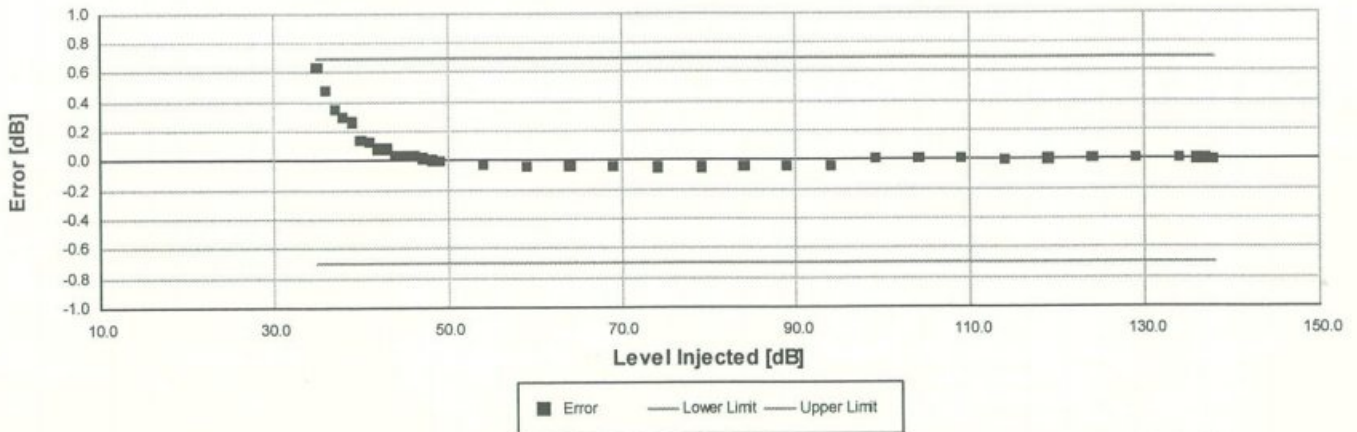


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.31	-0.31	-1.11	0.33	0.15	Pass
63.10	-0.07	-0.07	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.02	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.06	-0.06	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass

-- End of measurement results--

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
35.00	0.64	-0.70	0.70	0.16	Pass
36.00	0.49	-0.70	0.70	0.16	Pass
37.00	0.35	-0.70	0.70	0.16	Pass
38.00	0.30	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.14	-0.70	0.70	0.16	Pass
41.00	0.13	-0.70	0.70	0.16	Pass
42.00	0.09	-0.70	0.70	0.16	Pass
43.00	0.09	-0.70	0.70	0.17	Pass
44.00	0.03	-0.70	0.70	0.17	Pass
45.00	0.04	-0.70	0.70	0.16	Pass
46.00	0.04	-0.70	0.70	0.16	Pass
47.00	0.02	-0.70	0.70	0.16	Pass
48.00	0.01	-0.70	0.70	0.16	Pass
49.00	0.00	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
64.00	-0.03	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.02	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	135.14	133.65	135.65	0.15	Pass
		Positive Pulse	135.12	133.64	135.64	0.15	Pass
	30	Negative Pulse	134.20	133.65	135.65	0.15	Pass
		Positive Pulse	134.20	133.64	135.64	0.15	Pass
-- End of measurement results--							

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.14	± 1.00	0.15 ‡	Pass
	5	-0.15	± 1.00	0.16 ‡	Pass
115.95	3	-0.14	± 1.00	0.15 ‡	Pass
	5	-0.14	± 1.00	0.15 ‡	Pass
105.95	3	-0.15	± 1.00	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
-- End of measurement results--					

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ‡	Pass
	5	OVLD	± 1.00	0.15 ‡	Pass
125.95	3	-0.12	± 1.00	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
115.95	3	-0.13	± 1.00	0.15 ‡	Pass
	5	-0.13	± 1.00	0.15 ‡	Pass
105.95	3	-0.14	± 1.00	0.15 ‡	Pass
	5	-0.12	± 1.00	0.15 ‡	Pass
-- End of measurement results--					

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.96	93.91	94.11	0.15	Pass
0 dB Gain, Linearity	40.26	39.41	40.81	0.16	Pass
OBA Low Range	94.02	93.91	94.11	0.15	Pass
OBA Normal Range	94.01	93.20	94.80	0.15	Pass
-- End of measurement results--					

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.93	36.00	Pass
C-weight Noise Floor	26.82	35.00	Pass
Z-weight Noise Floor	32.70	39.00	Pass

-- End of measurement results--

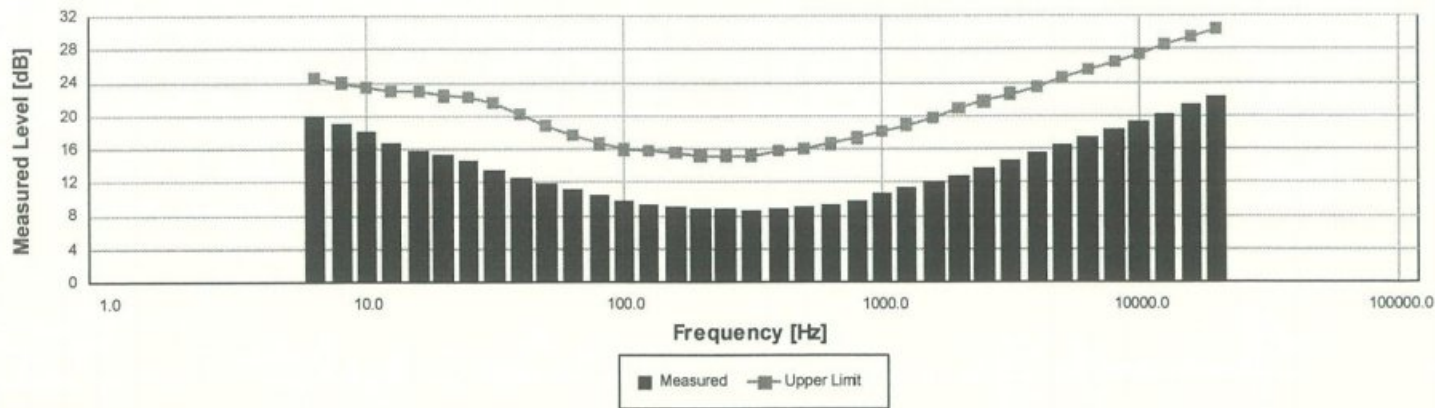
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.67	134.15	135.75	0.15	Pass
THD	-65.74		-58.00	0.01 ‡	Pass
THD+N	-62.05		-58.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.93	24.60	Pass
8.00	19.05	24.00	Pass
10.00	18.09	23.50	Pass
12.50	16.82	23.00	Pass
16.00	15.82	22.90	Pass
20.00	15.31	22.40	Pass
25.00	14.66	22.30	Pass
31.50	13.58	21.50	Pass
40.00	12.50	20.20	Pass
50.00	11.82	18.80	Pass
63.00	11.10	17.60	Pass
80.00	10.41	16.60	Pass
100.00	9.77	15.90	Pass
125.00	9.30	15.70	Pass
160.00	9.00	15.50	Pass
200.00	8.78	15.20	Pass
250.00	8.72	15.20	Pass
315.00	8.68	15.20	Pass
400.00	8.73	15.70	Pass
500.00	8.96	16.00	Pass
630.00	9.37	16.60	Pass
800.00	9.86	17.30	Pass
1,000.00	10.60	18.10	Pass
1,250.00	11.29	18.90	Pass
1,600.00	12.01	19.80	Pass
2,000.00	12.77	20.80	Pass
2,500.00	13.64	21.70	Pass
3,150.00	14.52	22.60	Pass
4,000.00	15.43	23.50	Pass
5,000.00	16.38	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.30	26.50	Pass
10,000.00	19.27	27.40	Pass
12,500.00	20.25	28.50	Pass
16,000.00	21.24	29.50	Pass
20,000.00	22.23	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022003094

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006692
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 11 Mar 2022
Calibration Due
Temperature 23.48 °C ± 0.25 °C
Humidity 51.5 %RH ± 2.0 %RH
Static Pressure 87.17 kPa ± 0.13 kPa

Evaluation Method **Tested with:** **Data reported in dB re 20 µPa.**
Larson Davis CAL200. S/N 9079
Larson Davis PRMLxT2C. S/N 071561
PCB 375A04. S/N 335076
Larson Davis CAL291. S/N 0108

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.11 (R2009) Class 2
IEC 61260:2001 Class 2	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2

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.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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Certificate Number 2022003094

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2021-09-10	2022-09-10	001250
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
Larson Davis CAL200 Acoustic Calibrator	2021-07-21	2022-07-21	007027
Larson Davis Model 831	2022-02-21	2023-02-21	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2022-03-02	2023-03-02	007185
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2021-09-28	2022-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-49.51	-52.44	-48.33	0.14	Pass

-- End of measurement results--

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2022-3-11T12:36:34

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.22	-0.20	-1.70	1.30	0.23	Pass
1000	0.12	0.00	-1.00	1.00	0.23	Pass
8000	-3.06	-3.00	-8.00	2.00	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.69

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002971

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006692
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 9 Mar 2022
Calibration Due
Temperature 23.91 °C ± 0.25 °C
Humidity 50.6 %RH ± 2.0 %RH
Static Pressure 85.35 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071561 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 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 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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.

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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

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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2021-07-22	2022-07-22	007174

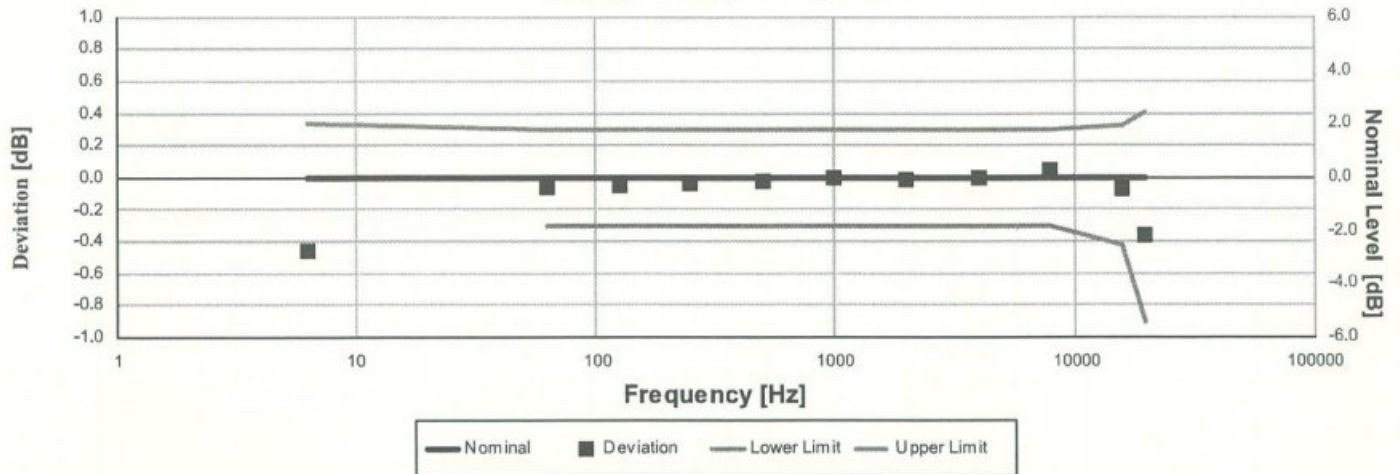
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Z-weight Filter Response

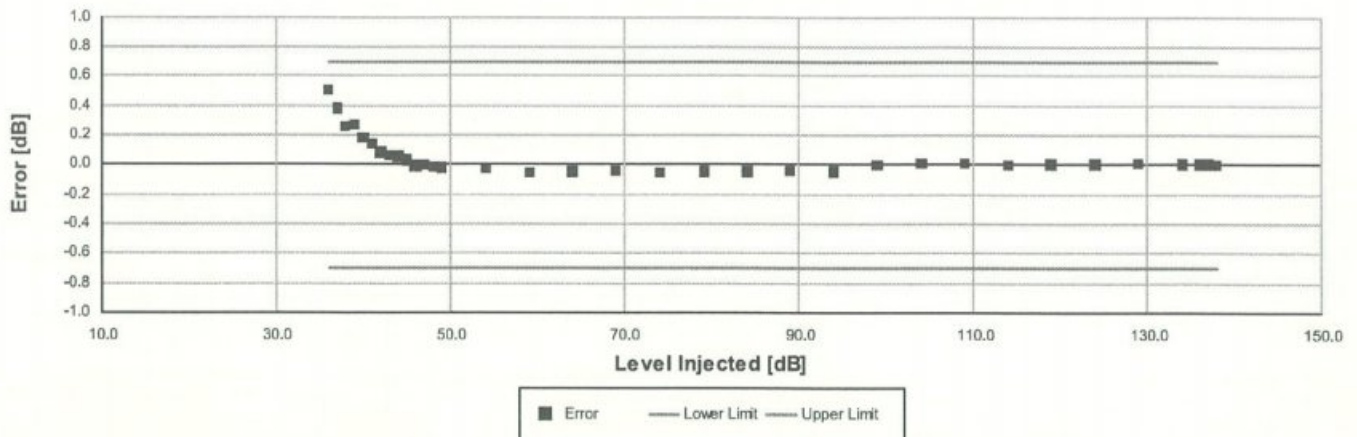


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.45	-0.45	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.01	-0.01	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.05	0.05	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.36	-0.36	-0.91	0.41	0.15	Pass

-- End of measurement results--

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.50	-0.70	0.70	0.16	Pass
37.00	0.38	-0.70	0.70	0.16	Pass
38.00	0.26	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.18	-0.70	0.70	0.16	Pass
41.00	0.15	-0.70	0.70	0.16	Pass
42.00	0.08	-0.70	0.70	0.16	Pass
43.00	0.06	-0.70	0.70	0.17	Pass
44.00	0.05	-0.70	0.70	0.17	Pass
45.00	0.03	-0.70	0.70	0.16	Pass
46.00	0.00	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	-0.01	-0.70	0.70	0.16	Pass
49.00	-0.02	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
99.00	0.00	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.00	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

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Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	135.03	133.55	135.55	0.15	Pass
		Positive Pulse	135.12	133.64	135.64	0.15	Pass
	30	Negative Pulse	133.78	133.55	135.55	0.15	Pass
		Positive Pulse	133.90	133.64	135.64	0.15	Pass
	-- End of measurement results--						

Positive Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVLD	± 1.00	0.15 ‡	Pass
	5		OVLD	± 1.00	0.15 ‡	Pass
125.95	3		-0.15	± 1.00	0.15 ‡	Pass
	5		-0.14	± 1.00	0.16 ‡	Pass
115.95	3		-0.15	± 1.00	0.15 ‡	Pass
	5		-0.14	± 1.00	0.15 ‡	Pass
105.95	3		-0.12	± 1.00	0.15 ‡	Pass
	5		-0.13	± 1.00	0.15 ‡	Pass
-- End of measurement results--						

Negative Pulse Crest Factor

200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVLD	± 1.00	0.15 ‡	Pass
	5		OVLD	± 1.00	0.15 ‡	Pass
125.95	3		-0.20	± 1.00	0.15 ‡	Pass
	5		-0.19	± 1.00	0.15 ‡	Pass
115.95	3		-0.21	± 1.00	0.15 ‡	Pass
	5		-0.18	± 1.00	0.15 ‡	Pass
105.95	3		-0.15	± 1.00	0.15 ‡	Pass
	5		-0.17	± 1.00	0.15 ‡	Pass
-- End of measurement results--						

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.89	94.09	0.15	Pass
0 dB Gain, Linearity	40.30	39.39	40.79	0.16	Pass
OBA Low Range	93.99	93.89	94.09	0.15	Pass
OBA Normal Range	93.99	93.20	94.80	0.15	Pass
-- End of measurement results--					

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.87	36.00	Pass
C-weight Noise Floor	26.80	35.00	Pass
Z-weight Noise Floor	32.77	39.00	Pass

-- End of measurement results--

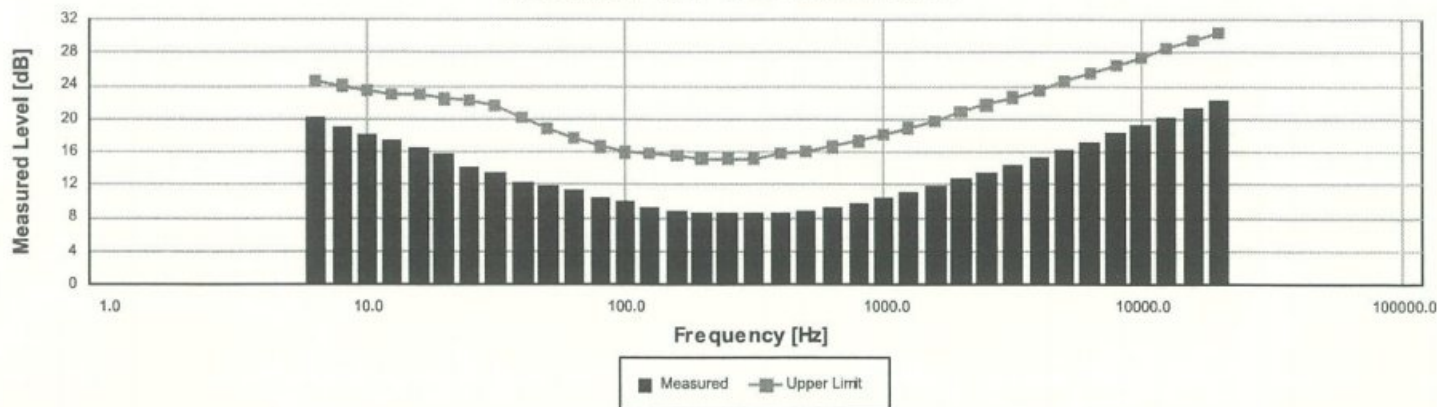
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.67	134.15	135.75	0.15	Pass
THD	-67.46		-58.00	0.01 ‡	Pass
THD+N	-62.99		-58.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.21	24.60	Pass
8.00	19.11	24.00	Pass
10.00	18.05	23.50	Pass
12.50	17.39	23.00	Pass
16.00	16.36	22.90	Pass
20.00	15.76	22.40	Pass
25.00	14.17	22.30	Pass
31.50	13.44	21.50	Pass
40.00	12.40	20.20	Pass
50.00	11.80	18.80	Pass
63.00	11.26	17.60	Pass
80.00	10.46	16.60	Pass
100.00	10.00	15.90	Pass
125.00	9.22	15.70	Pass
160.00	8.88	15.50	Pass
200.00	8.61	15.20	Pass
250.00	8.49	15.20	Pass
315.00	8.48	15.20	Pass
400.00	8.54	15.70	Pass
500.00	8.83	16.00	Pass
630.00	9.25	16.60	Pass
800.00	9.78	17.30	Pass
1,000.00	10.35	18.10	Pass
1,250.00	11.10	18.90	Pass
1,600.00	11.86	19.80	Pass
2,000.00	12.67	20.80	Pass
2,500.00	13.54	21.70	Pass
3,150.00	14.41	22.60	Pass
4,000.00	15.39	23.50	Pass
5,000.00	16.36	24.50	Pass
6,300.00	17.29	25.50	Pass
8,000.00	18.25	26.50	Pass
10,000.00	19.28	27.40	Pass
12,500.00	20.24	28.50	Pass
16,000.00	21.24	29.50	Pass
20,000.00	22.22	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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D0001.8407 Rev F

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Calibration Certificate

Certificate Number 2022002973

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006693
Test Results **Pass**

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 9 Mar 2022

Calibration Due
Temperature 23.73 °C ± 0.25 °C
Humidity 49.5 %RH ± 2.0 %RH
Static Pressure 85.37 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071562 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 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 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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.

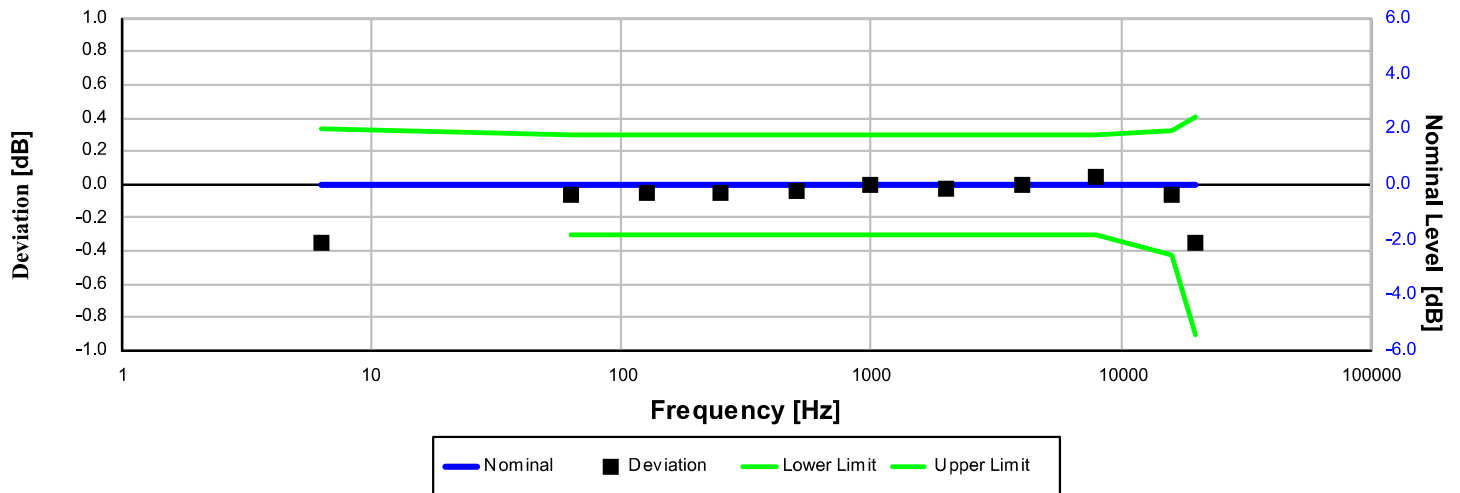
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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev O Supporting Firmware Version 4.0.5, 2019-09-10

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

Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2022-01-03	2023-01-03	007118

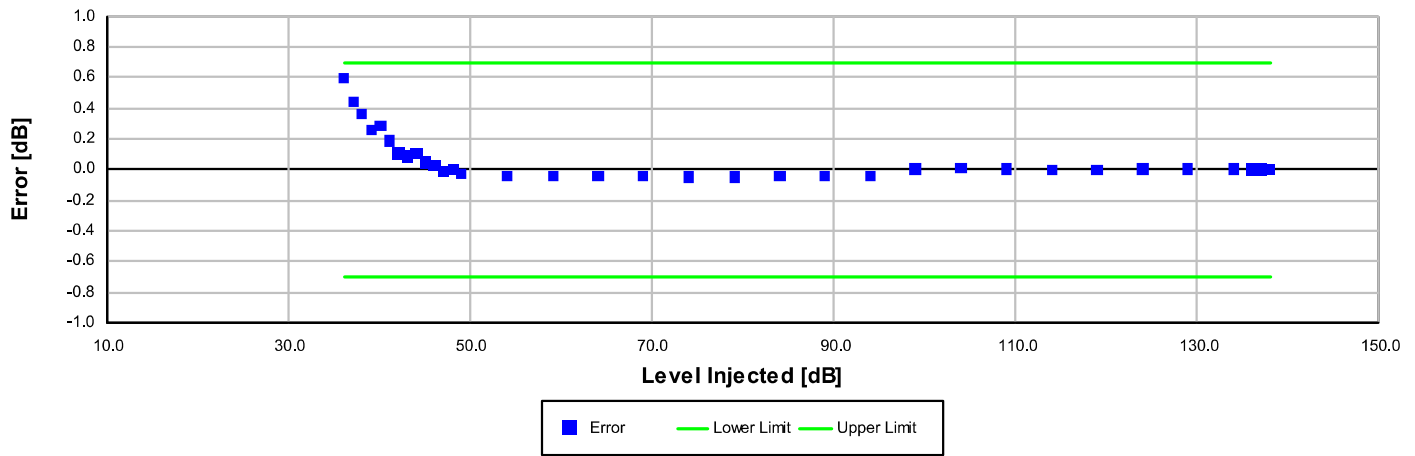
Z-weight Filter Response



Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.35	-0.35	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.05	-0.05	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.02	-0.02	-0.30	0.30	0.15	Pass
3,981.07	-0.01	-0.01	-0.30	0.30	0.15	Pass
7,943.28	0.04	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.07	-0.07	-0.42	0.32	0.15	Pass
19,952.62	-0.35	-0.35	-0.91	0.41	0.15	Pass
-- End of measurement results--						

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
36.00	0.60	-0.70	0.70	0.16	Pass
37.00	0.44	-0.70	0.70	0.16	Pass
38.00	0.37	-0.70	0.70	0.16	Pass
39.00	0.26	-0.70	0.70	0.16	Pass
40.00	0.28	-0.70	0.70	0.16	Pass
41.00	0.19	-0.70	0.70	0.16	Pass
42.00	0.11	-0.70	0.70	0.16	Pass
43.00	0.08	-0.70	0.70	0.17	Pass
44.00	0.10	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.02	-0.70	0.70	0.16	Pass
47.00	-0.01	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.03	-0.70	0.70	0.16	Pass
54.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.00	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.00	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass

-- End of measurement results--

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	135.01	133.52	135.52	0.15	Pass
		Positive Pulse	134.99	133.51	135.51	0.15	Pass
	30	Negative Pulse	134.07	133.52	135.52	0.15	Pass
		Positive Pulse	134.07	133.51	135.51	0.15	Pass

-- End of measurement results--

Positive Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.15	± 1.00	0.16 ±	Pass
115.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass
105.95	3	-0.15	± 1.00	0.15 ±	Pass
	5	-0.14	± 1.00	0.15 ±	Pass

-- End of measurement results--

Negative Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor	Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3	OVLD	± 1.00	0.15 ±	Pass
	5	OVLD	± 1.00	0.15 ±	Pass
125.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.11	± 1.00	0.15 ±	Pass
115.95	3	-0.13	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass
105.95	3	-0.14	± 1.00	0.15 ±	Pass
	5	-0.13	± 1.00	0.15 ±	Pass

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.96	93.92	94.12	0.15	Pass
0 dB Gain, Linearity	40.29	39.42	40.82	0.16	Pass
OBA Low Range	94.02	93.92	94.12	0.15	Pass
OBA Normal Range	94.02	93.20	94.80	0.15	Pass

-- End of measurement results--

Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.08	36.00	Pass
C-weight Noise Floor	26.90	35.00	Pass
Z-weight Noise Floor	32.76	39.00	Pass

-- End of measurement results--

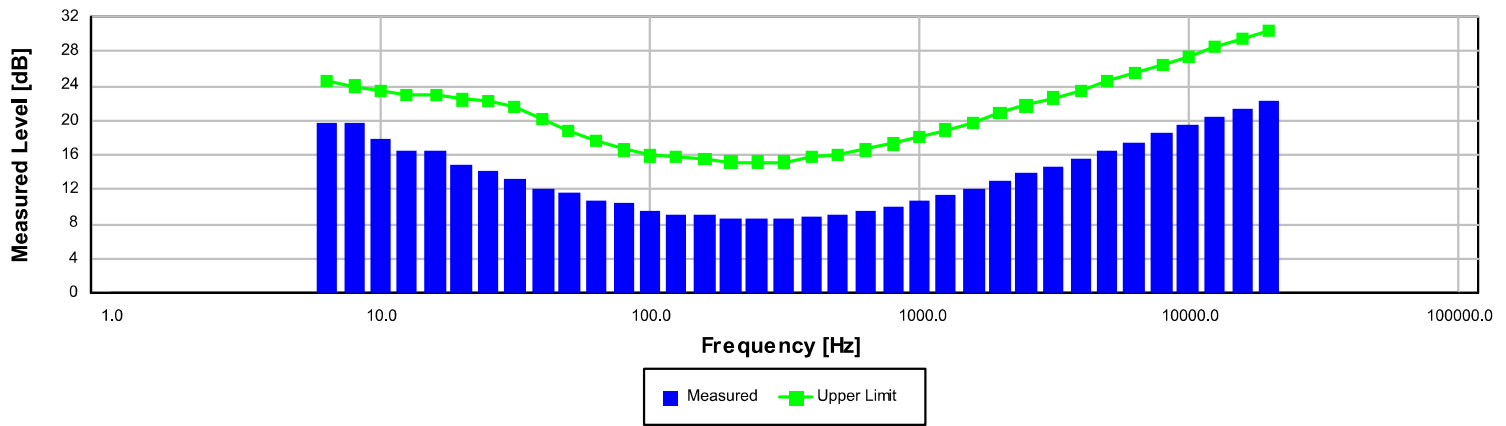
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.53	134.15	135.75	0.15	Pass
THD	-67.24		-58.00	0.01 ‡	Pass
THD+N	-63.03		-58.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.82	24.60	Pass
8.00	19.80	24.00	Pass
10.00	17.93	23.50	Pass
12.50	16.57	23.00	Pass
16.00	16.43	22.90	Pass
20.00	14.79	22.40	Pass
25.00	14.06	22.30	Pass
31.50	13.20	21.50	Pass
40.00	12.12	20.20	Pass
50.00	11.65	18.80	Pass
63.00	10.68	17.60	Pass
80.00	10.37	16.60	Pass
100.00	9.56	15.90	Pass
125.00	9.15	15.70	Pass
160.00	8.94	15.50	Pass
200.00	8.64	15.20	Pass
250.00	8.63	15.20	Pass
315.00	8.57	15.20	Pass
400.00	8.85	15.70	Pass
500.00	9.05	16.00	Pass
630.00	9.46	16.60	Pass
800.00	10.00	17.30	Pass
1,000.00	10.69	18.10	Pass
1,250.00	11.33	18.90	Pass
1,600.00	12.15	19.80	Pass
2,000.00	12.96	20.80	Pass
2,500.00	13.82	21.70	Pass
3,150.00	14.67	22.60	Pass
4,000.00	15.61	23.50	Pass
5,000.00	16.52	24.50	Pass
6,300.00	17.49	25.50	Pass
8,000.00	18.47	26.50	Pass
10,000.00	19.40	27.40	Pass
12,500.00	20.42	28.50	Pass
16,000.00	21.33	29.50	Pass
20,000.00	22.34	30.40	Pass

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Provo, UT 84601, United States
716-684-0001

2022-3-9T18:28:48



Calibration Certificate

Certificate Number 2022003098

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006694
Test Results Pass

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 11 Mar 2022
Calibration Due
Temperature 23.64 °C ± 0.25 °C
Humidity 50.9 %RH ± 2.0 %RH
Static Pressure 87.2 kPa ± 0.13 kPa

Evaluation Method

Tested with:

Larson Davis PRMLxT2C. S/N 071563
PCB 375A04. S/N 335078
Larson Davis CAL291. S/N 0108
Larson Davis CAL200. S/N 9079

Data reported in dB re 20 µPa.

Compliance Standards

Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.11 (R2009) Class 2
IEC 61260:2001 Class 2	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2

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.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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Certificate Number 2022003098

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2021-09-10	2022-09-10	001250
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
Larson Davis CAL200 Acoustic Calibrator	2021-07-21	2022-07-21	007027
Larson Davis Model 831	2022-02-21	2023-02-21	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2022-03-02	2023-03-02	007185
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2021-09-28	2022-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-51.12	-52.44	-48.33	0.14	Pass

-- End of measurement results--

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.22	-0.20	-1.70	1.30	0.23	Pass
1000	0.16	0.00	-1.00	1.00	0.23	Pass
8000	-2.84	-3.00	-8.00	2.00	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.78

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002974

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006694
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 9 Mar 2022
Calibration Due
Temperature 23.79 °C ± 0.25 °C
Humidity 50.3 %RH ± 2.0 %RH
Static Pressure 85.37 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071563 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 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 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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.

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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

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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2021-07-22	2022-07-22	007174

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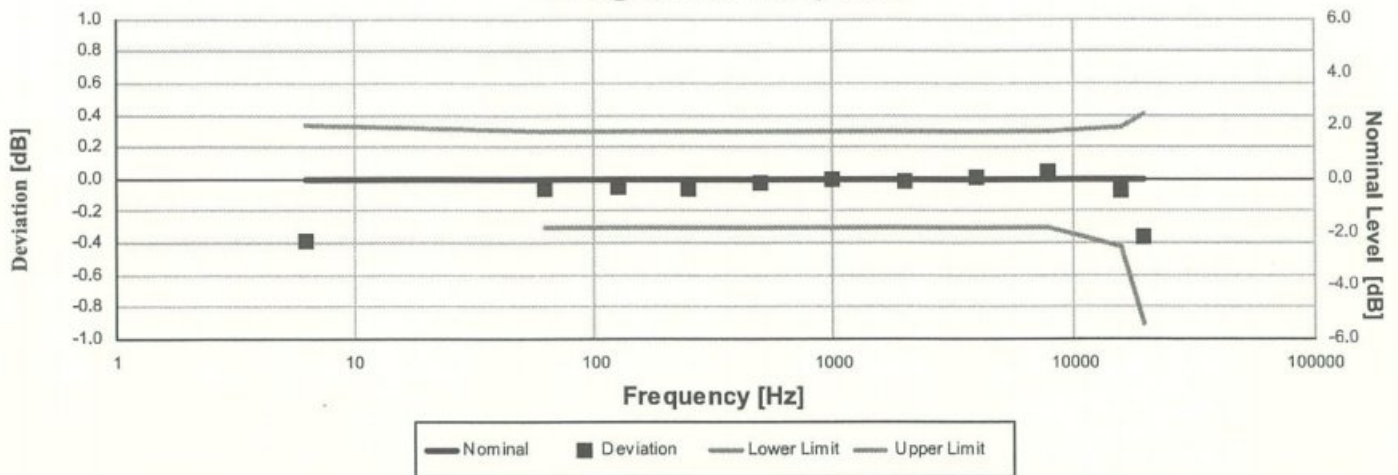
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Z-weight Filter Response

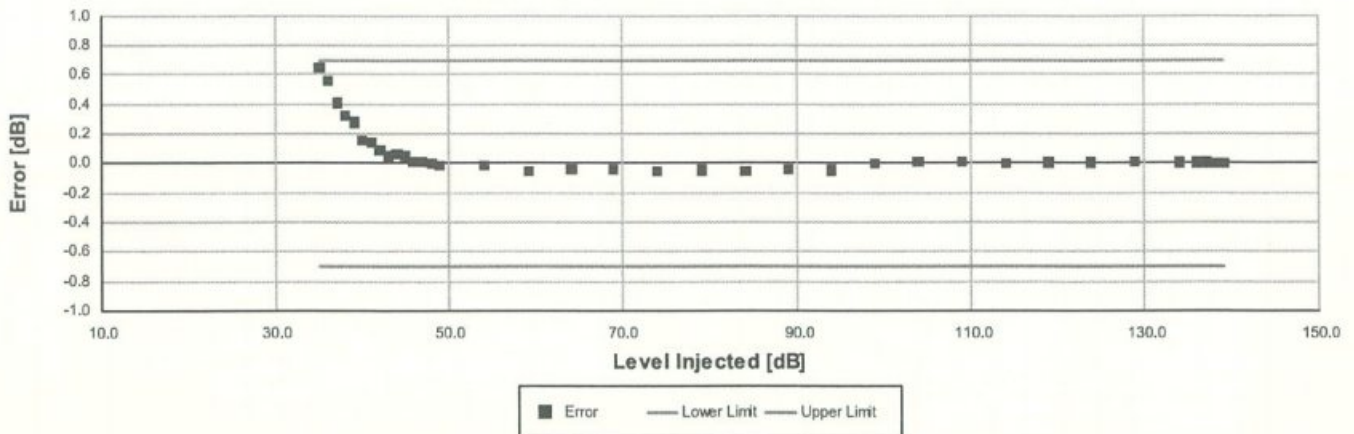


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.39	-0.39	-1.11	0.33	0.15	Pass
63.10	-0.06	-0.06	-0.30	0.30	0.15	Pass
125.89	-0.05	-0.05	-0.30	0.30	0.15	Pass
251.19	-0.06	-0.06	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.01	-0.01	-0.30	0.30	0.15	Pass
3,981.07	0.01	0.01	-0.30	0.30	0.15	Pass
7,943.28	0.05	0.05	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.36	-0.36	-0.91	0.41	0.15	Pass

-- End of measurement results--

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
35.00	0.65	-0.70	0.70	0.16	Pass
36.00	0.56	-0.70	0.70	0.16	Pass
37.00	0.41	-0.70	0.70	0.16	Pass
38.00	0.32	-0.70	0.70	0.16	Pass
39.00	0.28	-0.70	0.70	0.16	Pass
40.00	0.15	-0.70	0.70	0.16	Pass
41.00	0.14	-0.70	0.70	0.16	Pass
42.00	0.09	-0.70	0.70	0.16	Pass
43.00	0.04	-0.70	0.70	0.17	Pass
44.00	0.06	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.01	-0.70	0.70	0.16	Pass
47.00	0.01	-0.70	0.70	0.16	Pass
48.00	0.00	-0.70	0.70	0.16	Pass
49.00	-0.01	-0.70	0.70	0.16	Pass
54.00	-0.02	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
99.00	0.00	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.00	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

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-- End of measurement results--

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μs]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.96	133.48	135.48	0.15	Pass
		Positive Pulse	134.95	133.50	135.50	0.15	Pass
	30	Negative Pulse	134.03	133.48	135.48	0.15	Pass
		Positive Pulse	134.05	133.50	135.50	0.15	Pass

-- End of measurement results--

Positive Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVL	± 1.00	0.15 ±	Pass
	5		OVL	± 1.00	0.15 ±	Pass
125.95	3		-0.15	± 1.00	0.15 ±	Pass
	5		-0.15	± 1.00	0.16 ±	Pass
115.95	3		-0.16	± 1.00	0.15 ±	Pass
	5		-0.13	± 1.00	0.15 ±	Pass
105.95	3		-0.13	± 1.00	0.15 ±	Pass
	5		-0.14	± 1.00	0.15 ±	Pass

-- End of measurement results--

Negative Pulse Crest Factor**200 μs pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVL	± 1.00	0.15 ±	Pass
	5		OVL	± 1.00	0.15 ±	Pass
125.95	3		-0.17	± 1.00	0.15 ±	Pass
	5		-0.17	± 1.00	0.15 ±	Pass
115.95	3		-0.18	± 1.00	0.15 ±	Pass
	5		-0.15	± 1.00	0.15 ±	Pass
105.95	3		-0.16	± 1.00	0.15 ±	Pass
	5		-0.17	± 1.00	0.15 ±	Pass

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.89	94.09	0.15	Pass
0 dB Gain, Linearity	40.26	39.39	40.79	0.16	Pass
OBA Low Range	93.99	93.89	94.09	0.15	Pass
OBA Normal Range	93.99	93.20	94.80	0.15	Pass

-- End of measurement results--

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	27.00	36.00	Pass
C-weight Noise Floor	26.90	35.00	Pass
Z-weight Noise Floor	32.83	39.00	Pass

-- End of measurement results--

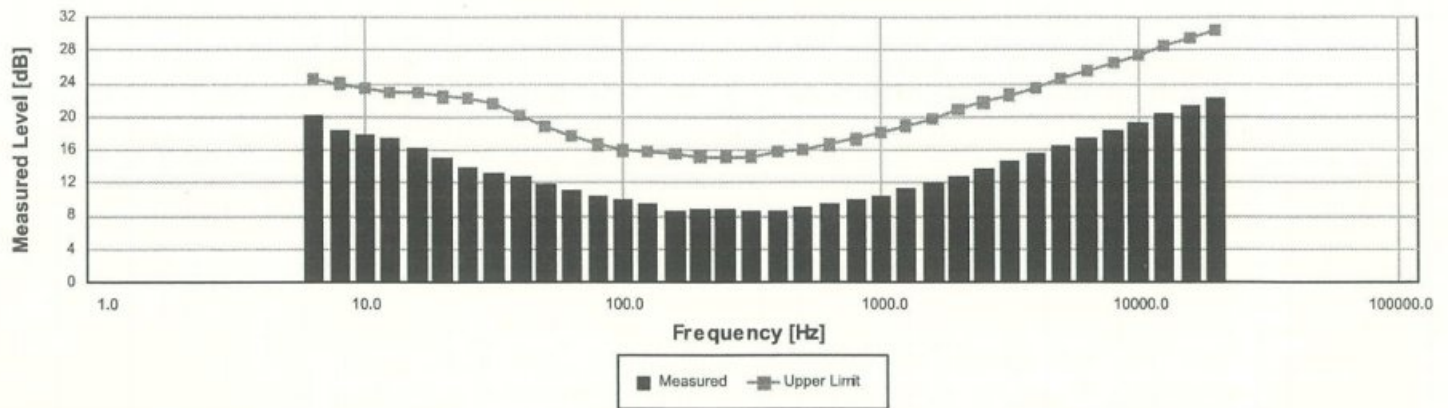
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.53	134.15	135.75	0.15	Pass
THD	-65.89		-58.00	0.01 ‡	Pass
THD+N	-62.16		-58.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	20.27	24.60	Pass
8.00	18.34	24.00	Pass
10.00	17.91	23.50	Pass
12.50	17.29	23.00	Pass
16.00	16.26	22.90	Pass
20.00	15.07	22.40	Pass
25.00	13.95	22.30	Pass
31.50	13.28	21.50	Pass
40.00	12.72	20.20	Pass
50.00	11.82	18.80	Pass
63.00	11.17	17.60	Pass
80.00	10.50	16.60	Pass
100.00	9.94	15.90	Pass
125.00	9.53	15.70	Pass
160.00	8.63	15.50	Pass
200.00	8.89	15.20	Pass
250.00	8.71	15.20	Pass
315.00	8.54	15.20	Pass
400.00	8.68	15.70	Pass
500.00	8.98	16.00	Pass
630.00	9.43	16.60	Pass
800.00	9.93	17.30	Pass
1,000.00	10.44	18.10	Pass
1,250.00	11.27	18.90	Pass
1,600.00	12.00	19.80	Pass
2,000.00	12.86	20.80	Pass
2,500.00	13.72	21.70	Pass
3,150.00	14.59	22.60	Pass
4,000.00	15.48	23.50	Pass
5,000.00	16.42	24.50	Pass
6,300.00	17.46	25.50	Pass
8,000.00	18.37	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.37	28.50	Pass
16,000.00	21.36	29.50	Pass
20,000.00	22.33	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022003099

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006695
Test Results Pass
Initial Condition As Manufactured
Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8384
Technician Jacob Cannon
Calibration Date 11 Mar 2022
Calibration Due
Temperature 23.59 °C ± 0.25 °C
Humidity 52.1 %RH ± 2.0 %RH
Static Pressure 87.19 kPa ± 0.13 kPa

Evaluation Method Tested with: Data reported in dB re 20 µPa.

Larson Davis CAL291. S/N 0108
Larson Davis CAL200. S/N 9079
Larson Davis PRMLxT2C. S/N 071564
PCB 375A04. S/N 335079

Compliance Standards Compliant to Manufacturer Specifications and the following standards when combined with Calibration Certificate from procedure D0001.8378:

IEC 60651:2001 Type 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.11 (R2009) Class 2
IEC 61260:2001 Class 2	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2

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.

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Correction data from Larson Davis LxT Manual for SoundTrack LxT & SoundExpert Lxt, I770.01 Rev J Supporting Firmware Version 2.301, 2015-04-30

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Certificate Number 2022003099

For 1/4" microphones, the Larson Davis ADP024 1/4" to 1/2" adaptor is used with the calibrators and the Larson Davis ADP043 1/4" to 1/2" adaptor is used with the preamplifier.

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

Periodic tests were performed in accordance with procedures from IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part3.

No Pattern approval for IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 available.

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3, for the environmental conditions under which the tests were performed. However, no general statement or conclusion can be made about conformance of the sound level meter to the full specifications of IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 because (a) evidence was not publicly available, from an independent testing organization responsible for pattern approvals, to demonstrate that the model of sound level meter fully conformed to the class 2 specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1 or correction data for acoustical test of frequency weighting were not provided in the Instruction Manual and (b) because the periodic tests of IEC 61672-3:2013 / ANSI/ASA S1.4-2014/Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSI/ASA S1.4-2014/Part 1.

Standards Used

Description	Cal Date	Cal Due	Cal Standard
Larson Davis CAL291 Residual Intensity Calibrator	2021-09-10	2022-09-10	001250
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
Larson Davis CAL200 Acoustic Calibrator	2021-07-21	2022-07-21	007027
Larson Davis Model 831	2022-02-21	2023-02-21	007182
PCB 377A13 1/2 inch Prepolarized Pressure Microphone	2022-03-02	2023-03-02	007185
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635
Larson Davis 1/2" Preamplifier for Model 831 Type 1	2021-09-28	2022-09-28	PCB0004783

Acoustic Calibration

Measured according to IEC 61672-3:2013 10 and ANSI S1.4-2014 Part 3: 10

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
1000 Hz	114.01	113.80	114.20	0.14	Pass

Loaded Circuit Sensitivity

Measurement	Test Result [dB re 1 V / Pa]	Lower Limit [dB re 1 V / Pa]	Upper Limit [dB re 1 V / Pa]	Expanded Uncertainty [dB]	Result
1000 Hz	-50.73	-52.44	-48.33	0.14	Pass

-- End of measurement results--

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Acoustic Signal Tests, C-weighting

Measured according to IEC 61672-3:2013 12 and ANSI S1.4-2014 Part 3: 12 using a comparison coupler with Unit Under Test (UUT) and reference SLM using slow time-weighted sound level for compliance to IEC 61672-1:2013 5.5; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Expected [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
125	-0.21	-0.20	-1.70	1.30	0.23	Pass
1000	0.15	0.00	-1.00	1.00	0.23	Pass
8000	-2.92	-3.00	-8.00	2.00	0.32	Pass

-- End of measurement results--

Self-generated Noise

Measured according to IEC 61672-3:2013 11.1 and ANSI S1.4-2014 Part 3: 11.1

Measurement	Test Result [dB]
A-weighted	40.79

-- End of measurement results--

-- End of Report--

Signatory: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002980

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonsuk 41, Sukhumvit Road,
Bangchak, Phra Khanong,
Bangkok, 10260, Thailand

Model Number LxT2
Serial Number 0006695
Test Results **Pass**

Initial Condition As Manufactured

Description SoundTrack LxT Class 2
Class 2 Sound Level Meter
Firmware Revision: 2.404

Procedure Number D0001.8378
Technician Jacob Cannon
Calibration Date 10 Mar 2022
Calibration Due
Temperature 23.55 °C ± 0.25 °C
Humidity 52.2 %RH ± 2.0 %RH
Static Pressure 85.9 kPa ± 0.13 kPa

Evaluation Method Tested electrically using Larson Davis PRMLxT2C S/N 071564 and a 12.0 pF capacitor to simulate microphone capacitance. Data reported in dB re 20 µPa assuming a microphone sensitivity of 50.0 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 2	ANSI S1.4-2014 Class 2
IEC 60804:2000 Type 2	ANSI S1.4 (R2006) Type 2
IEC 61252:2002	ANSI S1.25 (R2007)
IEC 61672:2013 Class 2	ANSI S1.43 (R2007) Type 2
IEC 61260:2001 Class 2	ANSI S1.11 (R2009) Class 2

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.

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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

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Description	Standards Used		
	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2021-07-22	2022-07-22	007174

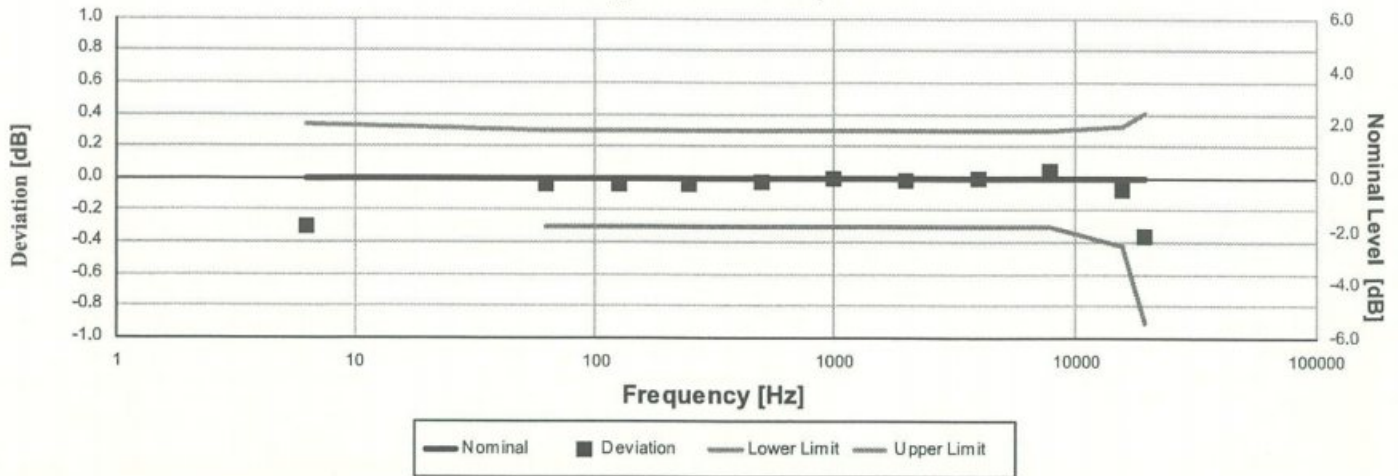
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2022-3-10T09:47:01



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Z-weight Filter Response

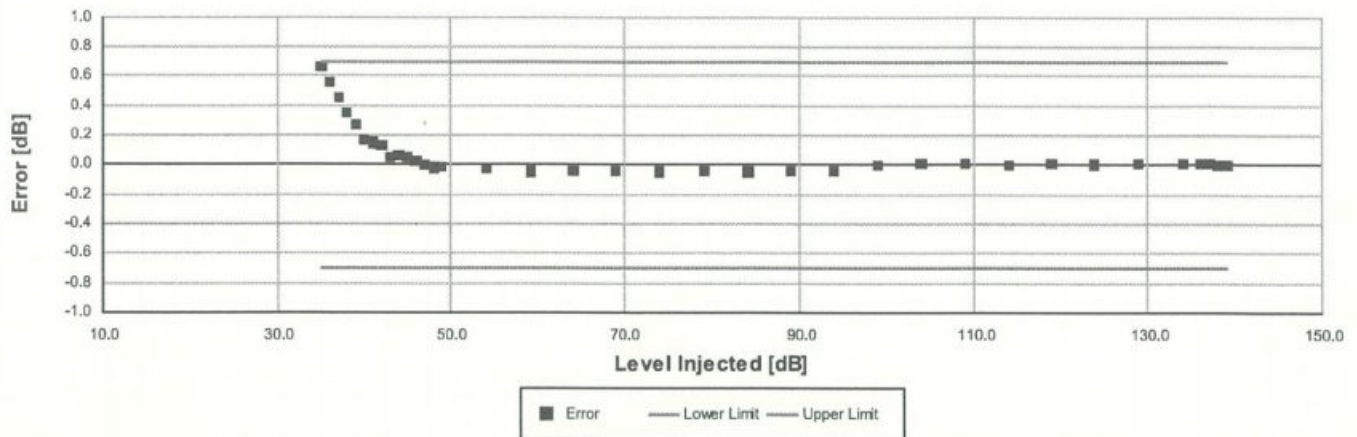


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3: 13 for compliance to IEC 61672-1:2013 5.5; IEC 60651:2001 6.1 and 9.2.2; IEC 60804:2000 5; ANSI S1.4:1983 (R2006) 5.1 and 8.2.1; ANSI S1.4-2014 Part 1: 5.5

Frequency [Hz]	Test Result [dB]	Deviation [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
6.31	-0.30	-0.30	-1.11	0.33	0.15	Pass
63.10	-0.04	-0.04	-0.30	0.30	0.15	Pass
125.89	-0.04	-0.04	-0.30	0.30	0.15	Pass
251.19	-0.04	-0.04	-0.30	0.30	0.15	Pass
501.19	-0.03	-0.02	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.01	-0.01	-0.30	0.30	0.15	Pass
3,981.07	0.00	0.00	-0.30	0.30	0.15	Pass
7,943.28	0.05	0.04	-0.30	0.30	0.15	Pass
15,848.93	-0.08	-0.08	-0.42	0.32	0.15	Pass
19,952.62	-0.36	-0.36	-0.91	0.41	0.15	Pass

-- End of measurement results--

A-weighted Broadband Log Linearity: 8,000.00 Hz



Broadband level linearity performed according to IEC 61672-3:2013 16 and ANSI S1.4-2014 Part 3: 16 for compliance to IEC 61672-1:2013 5.6, IEC 60804:2000 6.2, IEC 61252:2002 8, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
35.00	0.67	-0.70	0.70	0.16	Pass
36.00	0.56	-0.70	0.70	0.16	Pass
37.00	0.46	-0.70	0.70	0.16	Pass
38.00	0.35	-0.70	0.70	0.16	Pass
39.00	0.27	-0.70	0.70	0.16	Pass
40.00	0.17	-0.70	0.70	0.16	Pass
41.00	0.15	-0.70	0.70	0.16	Pass
42.00	0.12	-0.70	0.70	0.16	Pass
43.00	0.05	-0.70	0.70	0.17	Pass
44.00	0.07	-0.70	0.70	0.17	Pass
45.00	0.05	-0.70	0.70	0.16	Pass
46.00	0.03	-0.70	0.70	0.16	Pass
47.00	0.00	-0.70	0.70	0.16	Pass
48.00	-0.02	-0.70	0.70	0.16	Pass
49.00	-0.02	-0.70	0.70	0.16	Pass
54.00	-0.03	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.04	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
99.00	0.00	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.00	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
136.00	0.01	-0.70	0.70	0.15	Pass
137.00	0.01	-0.70	0.70	0.15	Pass
138.00	0.00	-0.70	0.70	0.15	Pass
139.00	0.00	-0.70	0.70	0.15	Pass

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-- End of measurement results--

Peak Rise Time

Peak rise time performed according to IEC 60651:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Amplitude [dB]	Duration [μ s]		Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
136.95	40	Negative Pulse	134.90	133.42	135.42	0.15	Pass
		Positive Pulse	134.93	133.45	135.45	0.15	Pass
	30	Negative Pulse	133.98	133.42	135.42	0.15	Pass
		Positive Pulse	133.97	133.45	135.45	0.15	Pass

-- End of measurement results--

Positive Pulse Crest Factor**200 μ s pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVLD	± 1.00	0.15 \pm	Pass
	5		OVLD	± 1.00	0.15 \pm	Pass
125.95	3		-0.14	± 1.00	0.15 \pm	Pass
	5		-0.13	± 1.00	0.16 \pm	Pass
115.95	3		-0.15	± 1.00	0.15 \pm	Pass
	5		-0.14	± 1.00	0.15 \pm	Pass
105.95	3		-0.12	± 1.00	0.15 \pm	Pass
	5		-0.14	± 1.00	0.15 \pm	Pass

-- End of measurement results--

Negative Pulse Crest Factor**200 μ s pulse tests at 2.0, 12.0, 22.0, 32.0 dB below Overload Limit**

Crest Factor measured according to IEC 60651:2001 9.4.2 and ANSI S1.4:1983 (R2006) 8.4.2

Amplitude [dB]	Crest Factor		Test Result [dB]	Limits [dB]	Expanded Uncertainty [dB]	Result
135.95	3		OVLD	± 1.00	0.15 \pm	Pass
	5		OVLD	± 1.00	0.15 \pm	Pass
125.95	3		-0.17	± 1.00	0.15 \pm	Pass
	5		-0.16	± 1.00	0.15 \pm	Pass
115.95	3		-0.18	± 1.00	0.15 \pm	Pass
	5		-0.17	± 1.00	0.15 \pm	Pass
105.95	3		-0.15	± 1.00	0.15 \pm	Pass
	5		-0.16	± 1.00	0.15 \pm	Pass

-- End of measurement results--

Gain

Gain measured according to IEC 61672-3:2013 17.3 and 17.4 and ANSI S1.4-2014 Part 3: 17.3 and 17.4

Measurement	Test Result [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
0 dB Gain	93.94	93.89	94.09	0.15	Pass
0 dB Gain, Linearity	40.24	39.39	40.79	0.16	Pass
OBA Low Range	93.99	93.89	94.09	0.15	Pass
OBA Normal Range	93.99	93.20	94.80	0.15	Pass

-- End of measurement results--

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Broadband Noise Floor

Self-generated noise measured according to IEC 61672-3:2013 11.2 and ANSI S1.4-2014 Part 3: 11.2

Measurement	Test Result [dB]	Upper limit [dB]	Result
A-weight Noise Floor	26.91	36.00	Pass
C-weight Noise Floor	26.54	35.00	Pass
Z-weight Noise Floor	32.44	39.00	Pass

-- End of measurement results--

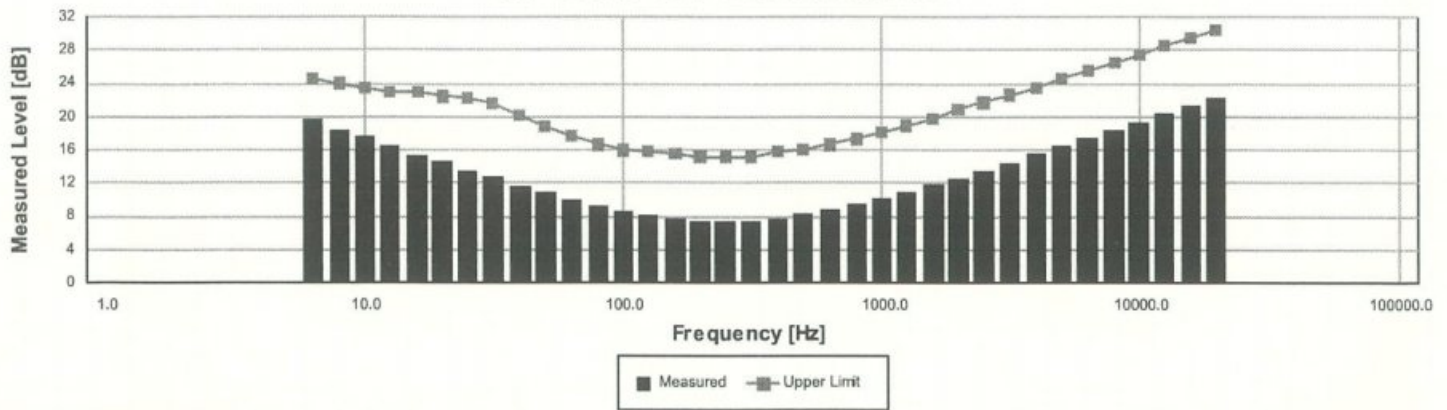
Total Harmonic Distortion

Measured using 1/3-Octave filters

Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.50	134.15	135.75	0.15	Pass
THD	-66.68		-58.00	0.01 ‡	Pass
THD+N	-62.67		-58.00	0.01 ‡	Pass

-- End of measurement results--

1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper limit [dB]	Result
6.30	19.80	24.60	Pass
8.00	18.31	24.00	Pass
10.00	17.59	23.50	Pass
12.50	16.50	23.00	Pass
16.00	15.41	22.90	Pass
20.00	14.52	22.40	Pass
25.00	13.40	22.30	Pass
31.50	12.87	21.50	Pass
40.00	11.60	20.20	Pass
50.00	10.89	18.80	Pass
63.00	10.00	17.60	Pass
80.00	9.34	16.60	Pass
100.00	8.61	15.90	Pass
125.00	8.12	15.70	Pass
160.00	7.68	15.50	Pass
200.00	7.42	15.20	Pass
250.00	7.39	15.20	Pass
315.00	7.39	15.20	Pass
400.00	7.76	15.70	Pass
500.00	8.25	16.00	Pass
630.00	8.82	16.60	Pass
800.00	9.48	17.30	Pass
1,000.00	10.17	18.10	Pass
1,250.00	10.99	18.90	Pass
1,600.00	11.76	19.80	Pass
2,000.00	12.63	20.80	Pass
2,500.00	13.52	21.70	Pass
3,150.00	14.48	22.60	Pass
4,000.00	15.47	23.50	Pass
5,000.00	16.42	24.50	Pass
6,300.00	17.34	25.50	Pass
8,000.00	18.38	26.50	Pass
10,000.00	19.35	27.40	Pass
12,500.00	20.34	28.50	Pass
16,000.00	21.33	29.50	Pass
20,000.00	22.34	30.40	Pass

-- End of measurement results--

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-- End of Report--

Signatory: Jacob Cannon

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Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT
CO.,LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Prakanong, Bangkok 10260

Certificate No : 23-ACT-067
Request No : Req-2023-0978

Unit Under Calibration Details

Measurement item : Acoustic Calibrator Class : 2
Manufacturer : LARSON DAVIS Range : 94 , 114 dB / 1000 Hz
Model : CAL150 Intrument Status : Used
Serial Number : 6307
ID : UAE.EFM.049/2563

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 9 May 2023
Calibration Date : 12 May 2023
Location of Calibration : LAB 1 Acoustic
Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2023
THD Multimeter	2015	1047765	NIMT	31 January 2024

Traceability : This certificate provides traceability of measurement to recognized national standard, and to the realization of the international System of Units (SI).

Note

The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k=2$, providing a level of confidence approximately 95 %.

Calibrated By : me
Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : นาย
Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 12 May 2023

Certificate No : 23-ACT-067

Request No : Req-2023-0978

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	93.98	-0.02	-	-	0.13	0.40
114 dB / 1000 Hz	114.12	0.12	-	-	0.13	0.40

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7
114 dB / 1000 Hz	999.11	0.09	-	-	0.01	1.7

Total Harmonic Distortion plus Noise of Sound pressure level (THD+N %)

Calibration Range (Hz)	Without Adjustment	Adjustment	Uncertainty (± %)	Acceptance limit Class 2 (± %)
	Measured (%)	Measured (%)		
94 dB / 1000 Hz	0.12	-	0.40	3.0
114 dB / 1000 Hz	0.22	-	0.40	3.0

Note :

- Acceptance limit was IEC60942:2017 Class 1
- The calibration results exclude the calibrator pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration



CLC
Accredited
ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14105/UM14105
CLID. NO. : 252001626
JOB CONTROL NO. : 230228022490

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 28 February 2023

DATE OF ISSUED : 02 March 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong

Calibration Engineer

Approved By :

Mongkol Yotsoontorn

Authorized Signatory

02 March 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23022490

F3-011-04/01-12

page 1 of 4

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@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM14105/UM14105
DATE OF CALIBRATION	:	01 March 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.
The calibration was performed by using Digital Multimeter, Universal Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. Universal Counter, HP Model 5315A S/N. 2448A13042.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0075/22, Due Date 27 July 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23022490

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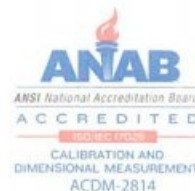


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CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.403	-0.003	1.9
0.5	50 Hz		0.500	0.504	-0.004	1.3
0.6	50 Hz		0.600	0.606	-0.006	1.3
0.7	50 Hz		0.700	0.707	-0.007	1.3
0.3	100 Hz	peak	0.300	0.304	-0.004	1.9
0.4	100 Hz		0.400	0.408	-0.008	1.9
0.5	100 Hz		0.500	0.510	-0.010	1.3
0.6	100 Hz		0.600	0.611	-0.011	1.3
0.7	100 Hz		0.700	0.713	-0.013	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.009	-0.009	1.8
4	50 Hz		4.000	4.014	-0.014	1.8
5	50 Hz		5.000	5.017	-0.017	1.8
6	50 Hz		6.000	6.021	-0.021	1.8
7	50 Hz		7.000	7.027	-0.027	1.8
3	100 Hz	peak	3.000	3.026	-0.026	1.8
4	100 Hz		4.000	4.032	-0.032	1.8
5	100 Hz		5.000	5.045	-0.045	1.8
6	100 Hz		6.000	6.061	-0.061	1.8
7	100 Hz		7.000	7.078	-0.078	1.8

Certificate No. Q23022490

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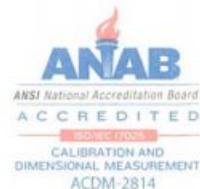


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CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	\pm (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.072	-0.002	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.051	-0.001	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.072	-0.002	1.2

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23022490

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เอกสารไม่ควบคุม



@clccalibration

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM14106/UM14106
CLID. NO. : 252100074
JOB CONTROL NO. : 230221019603

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 21 February 2023

DATE OF ISSUED : 24 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
24 February 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23019603

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REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM14106/UM14106
DATE OF CALIBRATION	:	22 February 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, High Resolution Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. High Resolution Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0001/22, Due Date 22 February 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. **Q23019603**

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.298	+0.002	1.9
0.4	50 Hz		0.400	0.397	+0.003	1.9
0.5	50 Hz		0.500	0.497	+0.003	1.3
0.6	50 Hz		0.600	0.596	+0.004	1.3
0.7	50 Hz		0.700	0.695	+0.005	1.3
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.404	-0.004	1.9
0.5	100 Hz		0.500	0.505	-0.005	1.3
0.6	100 Hz		0.600	0.606	-0.006	1.3
0.7	100 Hz		0.700	0.707	-0.007	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.011	-0.011	1.8
4	50 Hz		4.000	4.023	-0.023	1.8
5	50 Hz		5.000	5.035	-0.035	1.8
6	50 Hz		6.000	6.041	-0.041	1.8
7	50 Hz		7.000	7.056	-0.056	1.8
3	100 Hz	peak	3.000	3.021	-0.021	1.8
4	100 Hz		4.000	4.033	-0.033	1.8
5	100 Hz		5.000	5.044	-0.044	1.8
6	100 Hz		6.000	6.061	-0.061	1.8
7	100 Hz		7.000	7.073	-0.073	1.8

Certificate No. Q23019603

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CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.059	+0.001	1.3
*0.07	50 Hz		0.070	0.069	+0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.060	0.000	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23019603

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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11055/UM11055
CLID. NO. : 252000387
JOB CONTROL NO. : 230228022491

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 28 February 2023

DATE OF ISSUED : 02 March 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
02 March 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to
the International System of Units (SI)

Certificate No. Q23022491

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เอกสารไม่ควบคุม



@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM11055/UM11055
DATE OF CALIBRATION	:	01 March 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.

The calibration was performed by using Digital Multimeter, Universal Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. Universal Counter, HP Model 5315A S/N. 2448A13042.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0075/22, Due Date 27 July 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. **Q23022491**

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CALIBRATION LABORATORY Co., LTD.

2/10-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230

Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail: sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.404	-0.004	1.9
0.5	50 Hz		0.500	0.506	-0.006	1.3
0.6	50 Hz		0.600	0.608	-0.008	1.3
0.7	50 Hz		0.700	0.709	-0.009	1.3
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.3
0.6	100 Hz		0.600	0.609	-0.009	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.029	-0.029	1.8
4	50 Hz		4.000	4.041	-0.041	1.8
5	50 Hz		5.000	5.052	-0.052	1.8
6	50 Hz		6.000	6.061	-0.061	1.8
7	50 Hz		7.000	7.073	-0.073	1.8
3	100 Hz	peak	3.000	3.021	-0.021	1.8
4	100 Hz		4.000	4.017	-0.017	1.8
5	100 Hz		5.000	5.023	-0.023	1.8
6	100 Hz		6.000	6.031	-0.031	1.8
7	100 Hz		7.000	7.042	-0.042	1.8

Certificate No. Q23022491

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.060	0.000	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23022491

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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11056/UM11056
CLID. NO. : 252000389
JOB CONTROL NO. : 230211015867

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 11 February 2023

DATE OF ISSUED : 14 February 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong
Calibration Engineer

Approved By :

Mongkol Yotsoontorn
Authorized Signatory
14 February 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23015867

F3-011-04/01-12

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@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM11056/UM11056
DATE OF CALIBRATION	:	13 February 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.
The calibration was performed by using Digital Multimeter, High Resolution Programmable Timer/Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. High Resolution Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0001/22, Due Date 22 February 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23015867

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.304	-0.004	1.9
0.4	50 Hz		0.400	0.406	-0.006	1.9
0.5	50 Hz		0.500	0.507	-0.007	1.3
0.6	50 Hz		0.600	0.609	-0.009	1.3
0.7	50 Hz		0.700	0.711	-0.011	1.3
0.3	100 Hz	peak	0.300	0.302	-0.002	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.506	-0.006	1.3
0.6	100 Hz		0.600	0.607	-0.007	1.3
0.7	100 Hz		0.700	0.708	-0.008	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.041	-0.041	1.8
4	50 Hz		4.000	4.055	-0.055	1.8
5	50 Hz		5.000	5.071	-0.071	1.8
6	50 Hz		6.000	6.083	-0.083	1.8
7	50 Hz		7.000	7.091	-0.091	1.8
3	100 Hz	peak	3.000	3.037	-0.037	1.8
4	100 Hz		4.000	4.043	-0.043	1.8
5	100 Hz		5.000	5.059	-0.059	1.8
6	100 Hz		6.000	6.067	-0.067	1.8
7	100 Hz		7.000	7.079	-0.079	1.8

Certificate No. Q23015867

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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.060	0.000	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.060	0.000	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23015867

F3-011-04/01-12

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เอกสารไม่ควบคุม



@clccalibration

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11057/UM11057
CLID. NO. : 252000248
JOB CONTROL NO. : 230228022494

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 28 February 2023

DATE OF ISSUED : 02 March 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong
Calibration Engineer



Approved By :

Mongkol Yotsoontorn
Authorized Signatory
02 March 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23022494

F3-011-04/01-12

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เอกสารไม่ควบคุม



@clccalibration

REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM11057/UM11057
DATE OF CALIBRATION	:	01 March 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.
The calibration was performed by using Digital Multimeter, Universal Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. Universal Counter, HP Model 5315A S/N. 2448A13042.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0075/22, Due Date 27 July 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23022494

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เอกสารไม่ควบคุม



@clccalibration

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.304	-0.004	1.9
0.4	50 Hz		0.400	0.405	-0.005	1.9
0.5	50 Hz		0.500	0.507	-0.007	1.3
0.6	50 Hz		0.600	0.608	-0.008	1.3
0.7	50 Hz		0.700	0.709	-0.009	1.3
0.3	100 Hz	peak	0.300	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.508	-0.008	1.3
0.6	100 Hz		0.600	0.609	-0.009	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.031	-0.031	1.8
4	50 Hz		4.000	4.043	-0.043	1.8
5	50 Hz		5.000	5.055	-0.055	1.8
6	50 Hz		6.000	6.067	-0.067	1.8
7	50 Hz		7.000	7.073	-0.073	1.8
3	100 Hz	peak	3.000	3.038	-0.038	1.8
4	100 Hz		4.000	4.043	-0.043	1.8
5	100 Hz		5.000	5.058	-0.058	1.8
6	100 Hz		6.000	6.067	-0.067	1.8
7	100 Hz		7.000	7.079	-0.079	1.8

Certificate No. Q23022494

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ISO/IEC 17025

CALIBRATION LABORATORY Co., LTD.

2/10-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.060	0.000	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23022494

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เอกสารไม่ควบคุม



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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11058/UM11058
CLID. NO. : 252000350
JOB CONTROL NO. : 230228022493

CUSTOMER : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK, PHRAKHANONG, BANGKOK 10260

DATE OF RECEIVED : 28 February 2023

DATE OF ISSUED : 02 March 2023

Report of calibration screening must not be taken in part. Except complete. Without the approval of the Calibration Laboratory Co., Ltd.

Calibrated By :

Suwit Phuanbusabong
Calibration Engineer



Approved By :

Mongkol Yotsoontorn
Authorized Signatory
02 March 2023



This Calibration Certificate documents the traceability to national standards, which realize the units of measurement according to the International System of Units (SI)

Certificate No. Q23022493

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เอกสารไม่ควบคุม



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REPORT OF CALIBRATION FOR

NOMENCLATURE	:	VIBRATION METER
MANUFACTURER	:	INSTANTEL
MODEL / TYPE	:	721A2601/721A3301
SERIAL NO.	:	UM11058/UM11058
DATE OF CALIBRATION	:	01 March 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$

Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

This instrument was calibrated under procedure No. **CLC-CPEE-08** based on **ISO 16063-21** as calibration guideline.
The calibration was performed by using Digital Multimeter, Universal Counter, Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Digital Multimeter, Wavetek Model 1281 S/N. 29320.
2. Universal Counter, HP Model 5315A S/N. 2448A13042.
3. Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0207/21, Due Date 31 May 2023.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0075/22, Due Date 27 July 2023.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0009-22, Due Date 22 June 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2,00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23022493

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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.403	-0.003	1.9
0.5	50 Hz		0.500	0.504	-0.004	1.3
0.6	50 Hz		0.600	0.605	-0.005	1.3
0.7	50 Hz		0.700	0.706	-0.006	1.3
0.3	100 Hz	peak	0.300	0.304	-0.004	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.3
0.6	100 Hz		0.600	0.609	-0.009	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.026	-0.026	1.8
4	50 Hz		4.000	4.041	-0.041	1.8
5	50 Hz		5.000	5.054	-0.054	1.8
6	50 Hz		6.000	6.066	-0.066	1.8
7	50 Hz		7.000	7.072	-0.072	1.8
3	100 Hz	peak	3.000	3.044	-0.044	1.8
4	100 Hz		4.000	4.049	-0.049	1.8
5	100 Hz		5.000	5.051	-0.051	1.8
6	100 Hz		6.000	6.056	-0.056	1.8
7	100 Hz		7.000	7.061	-0.061	1.8

Certificate No. Q23022493

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.cal-laboratory.com E-mail:sale@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.050	0.000	1.5
*0.06	50 Hz		0.060	0.060	0.000	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.060	0.000	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

Note. * means Calibrations marked " Not ANAB Accredited " in this Certificate have been included for completeness.

The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 008 Page 1 of 58

This report is valid for the above stated instrument/s only.

End of Certificate

Certificate No. Q23022493

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รายการใบรับรองสอบเทียบ/ทวนสอบ เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์ สำหรับวิเคราะห์คุณภาพสิ่งแวดล้อม

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*	Remark
เครื่องมือหลักประจำห้องปฏิบัติการวิเคราะห์คุณภาพน้ำ									
1	pH Meter	ความเป็นกรด-ด่าง (pH)	Mettler-Toledo	Seven Easy S20 / 1230525212	National Food Institute, Ministry of Industry, Thailand	2302181-001-01	24 Mar 23	22 Mar 24	-
2	pH Meter		Mettler-Toledo	SevenCompact S220/ C113432421	National Food Institute, Ministry of Industry, Thailand	2303560-001-01	26 Jun 23	24 Jun 24	-
3	Analytical Balance (Readability 0.01 mg)	ของแข็งแขวนลอย (Suspended Solids)	Mettler-Toledo	XSR205DU / C210685394	Technology Promotion Association (Thailand-Japan)	23MM113	26 Apr 23	24 Apr 24	-
4	Hot Air Oven		Memmert	UF55 / B216.1666	National Food Institute, Ministry of Industry, Thailand	2400141-001-01	11 Oct 23	9 Oct 24	-
5	Analytical Balance (Readability 0.1 mg)	น้ำมันและไขมัน (Oil & Grease)	Mettler-Toledo	XSR204 / C117635043	National Food Institute, Ministry of Industry, Thailand	2302827-001-01	10 May 23	8 May 24	-
6	BOD Incubator	ความสกปรกในรูปความต้องการใช้ออกซิเจนสำหรับย่อยสลายอินทรีย์ (BOD3)	Arco	UC4-1320 / (UAE.WAO.015/2561)	Technology Promotion Association (Thailand-Japan)	23TM249	15 Feb 23	14 Feb 24	-
7	DO Meter		YSI	5100 / 11B101863	Harikul Science	HSU012C	1 Mar 23	28 Feb 24	-
8	Incubator	แบคทีเรียกลุ่มโคลิฟอร์มทั้งหมด (Total coliform bacteria)	Memmert	IPP 260 / V615.0187	Technology Promotion Association (Thailand-Japan)	23TM378	12 Apr 23	10 Apr 24	-
9	Water Bath		Memmert	WNE 14 / L416.0606	Technology Promotion Association (Thailand-Japan)	23TM193	15 Feb 23	14 Feb 24	-
10	Auto Clave		ALP	CL-40L / 807298	National Food Institute, Ministry of Industry, Thailand	2304203-001-01	10 Aug 23	8 Aug 24	-
11	Analytical Balance		Mettler-Toledo	MS603S / B007010311	Technology Promotion Association (Thailand-Japan)	23MM150	7 Apr 23	5 Apr 24	-

Due Date of Calibration* : Based on the annual calibration plan. At least 1 time per year.

Calibration Certificate

Certificate No.: 2302181-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: METTLER TOLEDO
Model: SevenEasy pH
Serial No.: 1230525212
ID No.: UAE.WAS.003/2553
Order No.: 2302181
Operation No.: 2302181-001
Date of Receipt: 14 March 2023
Date of Calibration: 24 March 2023

Calibrated by Mr.Pheraphat Tuanjit
Scientist

Approved by 
(Mr.Nuttapol Niyomchart)

Specialist, Division of Calibration Laboratory

Date of Issue: 24 March 2023

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302181-001-01

Equipment:

pH Meter

Resolution: 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1230525212

Type: Bench top

ID No.: UAE.WAS.003/2553

Date of Calibration: 24 March 2023

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: **Ambient Temperature:** (23.4 ± 1.5) °C **Relative Humidity:** (52 ± 3) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

<u>Instruments</u>	<u>Serial / ID No.</u>	<u>Manufacturer</u>	<u>Certificate No.</u>	<u>Due Date</u>
2.1 DC Voltage Calibrator	2709007	Fluke	22E1959	17 June 2023
2.2 Digital Thermometer	2709007	Fluke	CC-650557-01	30 October 2023
2.3 Thermo-Hygro Meter	NFI.BTH003/17	PONPE	TE 650555-01	21 September 2023
<u>Certified Reference Material</u>	<u>Lot. No.</u>	<u>Manufacturer</u>	<u>Ref N</u>	<u>Expire Date</u>
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025
2.6 pH buffer 10.01 (Primary pH buffer Solution)	873611	CPAchem	PH220.L5	16 February 2024
2.7 pH buffer 7.00 (Standard pH buffer Solution)	873612	CPAchem	PH107.L5	16 February 2024

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No.2.7	traceable to	BIM RefN HI-13 LotN 25.05.2022; BIM RefN HI-16 LotN 02.06.2022; BIM RefN HI-13 LotN 25.05.2022; BIM RefN HI-16 LotN 02.06.2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

N. Niyadach

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302181-001-01

Equipment:

pH Meter

Resolution: 0.01 pH ; 1 mV

Manufacturer: METTLER TOLEDO

Model: SevenEasy pH

Serial No.: 1230525212

Type: Bench top

ID No.: UAE.WAS.003/2553

Date of Calibration: 24 March 2023

Page 3 of 5

Calibration Results:

1. Calibration of pH Meter

(Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.120	414	0.00	0.58	2.00
2	295.814	296	2.00	0.58	2.00
4	177.464	178	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.000	0	7.00	0.58	2.00
8	-59.158	-59	8.00	0.58	2.00
10	-177.460	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.117	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode

Type: Combined Electrode

Manufacturer: METTLER TOLEDO

Model: InLab Solids

Serial No.: 1156883

ID.No. N/A

Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	187	-	0.0071	2.00
6.865	6.86	22	97.86	0.0075	2.00
10.010	10.01	-160	97.66	0.0086	2.00
6.985	6.99	14	-	0.0093	2.00

F-CS-012 Revision: 01 Date: 20-04-65

N. Nipudat



Calibration Report

Certificate No.: 2302181-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1230525212 ID No.: UAE.WAS.003/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 24 March 2023

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature 25 °C ± 1 °C

Relative Humidity 55 % ± 5 %

Condition of this results of Calibration:

- Calibration Method : - In house method: W-TE-025 by comparison with standard thermometer.
- The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
- The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1521	A85997	TE 660039-01	10-Dec-23	NATIONAL FOOD INSTITUTE
Platinum Resistance Thermometer (PRT)	385	509201			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good
- Result of Calibration : ☒ Without adjustment ☐ After adjustment

N. mignobert

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302181-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: SevenEasy pH

Serial No.: 1230525212 ID No.: UAE.WAS.003/2553

Manufacturer: METTLER TOLEDO

Date of Calibration: 24 March 2023

Page 5 of 5

Calibration point: 15.0, 25.0 and 30.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 120 mm.
- Description of probe, model : N/A S/N : N/A
- Dimension of probe : Diameter 3 mm., Length 120 mm.,
- Sheath material : N/A

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.2	14.999	- 0.2	0.12
25.2	24.999	- 0.2	0.12
30.2	29.999	- 0.2	0.12

Note

- UUC* : Unit Under Calibration

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

N. Vinyuth

F-CS-012 Revision: 01 Date: 20-04-65




Calibration Certificate

Certificate No.: 2303560-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 5

Equipment: pH Meter
Manufacturer: Mettler Toledo
Model: Seven Compact S220
Serial No.: C113432421
ID No.: UAE.WAT.009/2564
Order No.: 2303560
Operation No.: 2303560-001
Date of Receipt: 23 June 2023
Date of Calibration: 26 June 2023

Calibrated by Mr.Worapob Sooktong
Scientist

Approved by 
(Mr.Pheraphat Tuanjit) (for)
Manager, Division of Calibration Laboratory

Date of Issue: 27 June 2023

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2303560-001-01

Equipment:

pH Meter

Resolution: 0.01 pH ; 1 mV

Manufacturer: Mettler Toledo

Model: Seven Compact S220

Serial No.: C113432421

Type: Bench top

ID No.: UAE.WAT.009/2564

Date of Calibration: 26 June 2023

Page 2 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition: Ambient Temperature: (24.3 ± 1.5) °C Relative Humidity: (49 ± 3) %

Condition of Equipment: Good Condition

Condition of this Results of Calibration

1. Calibration Method In house method : W-CC-002 based on direct measurement by using standard voltage calibrator and certified reference material (CRM)

2. Reference Standards / Certified Reference Material

Instruments	Serial / ID No.	Manufacturer	Certificate No.	Due Date
2.1 DC Voltage Calibrator	2709007	Fluke	23E2003	14 June 2024
2.2 Digital Thermometer	2709007	Fluke	CC-650557-01	30 October 2023
2.3 Thermo-Hygro Meter	NFI.BTH003/17	PONPE	TE 650555-01	21 September 2023
Certified Reference Material	Lot. No.	Manufacturer	Ref N	Expire Date
2.4 pH buffer 4.008 (Primary pH buffer Solution)	873608	CPAchem	PH216.L5	16 February 2025
2.5 pH buffer 7.00 (Standard pH buffer Solution)	873612	CPAchem	PH107.L5	16 February 2024
2.6 pH buffer 10.01 (Primary pH buffer Solution)	873611	CPAchem	PH220.L5	16 February 2024
2.7 pH buffer 6.865 (Primary pH buffer Solution)	873609	CPAchem	PH217.L5	16 February 2025

3. This certification is traceable to The International System of Unit (SI Unit)

3.1 Instruments No.2.1	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0008
3.2 Instruments No.2.2	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.3 Instruments No.2.3	through	NSC-TISI-TIS 17025 Laboratory Accreditation of Calibration No.0061
3.4 Certified Reference Material No. 2.4 to 2.6	traceable to	Primary measurement method- Harned cell using calibrated thermometer, barometer, and nanovoltmeter. The Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025
3.5 Certified Reference Material No.2.7	traceable to	BIM RefN HI-13 LotN 25.05.2022; BIM RefN HI-16 LotN 02.06.2022; BIM RefN HI-13 LotN 25.05.2022; BIM RefN HI-16 LotN 02.06.2022, the Standard Solution preparation and certified by CPAchem Ltd is accredited to ISO 17034 and ISO/IEC 17025

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

S. Jenghambit
27 June 2023

F-CS-012 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2303560-001-01

Equipment: pH Meter **Resolution:** 0.01 pH ; 1 mV

Manufacturer: Mettler Toledo **Model:** Seven Compact S220

Serial No.: C113432421 **Type:** Bench top

ID No.: UAE.WAT.009/2564

Date of Calibration: 26 June 2023

Page 3 of 5

Calibration Results:

1. Calibration of pH Meter (Manual Temperature Compensation at 25 °C)

Nominal pH	DC Voltage Standard (mV)	Average Indicator Reading		Uncertainty (±mV)	Coverage Factor (k)
		mV	pH		
0	414.121	414	0.00	0.58	2.00
2	295.814	295	2.00	0.58	2.00
4	177.464	177	4.00	0.58	2.00
6	59.160	59	6.00	0.58	2.00
7	0.001	0	7.00	0.58	2.00
8	-59.159	-59	8.00	0.58	2.00
10	-177.461	-177	10.00	0.58	2.00
12	-295.811	-296	12.00	0.58	2.00
14	-414.118	-414	14.00	0.58	2.00

2. Calibration of pH Meter with Electrode (Manual Temperature Compensation at 25 °C)

Equipment: pH Electrode **Type:** Combined Electrode

Manufacturer: Mettler Toledo **Model:** InLab Expert Pro-ISM

Serial No.: 3114136 **ID.No.:** N/A

Performance of Electrode system (Three-Point Calibration at pH 4, pH 7 and pH 10)

Certified Value @25 °C (pH)	Average Indicator Reading		Relative Slope (%)	Uncertainty (± pH)	Coverage Factor (k)
	pH	mV			
4.008	4.01	177	-	0.0071	2.00
6.865	6.90	9	98.26	0.0074	2.00
10.01	10.01	-168	96.20	0.0085	2.00
6.986	7.02	3	-	0.0093	2.00

P. Jongsamrit

27 June 2023



Calibration Report

Certificate No.: 2303560-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C **Model:** Seven Compact S220

Serial No.: C113432421 **ID No.:** UAE.WAT.009/2564

Manufacturer: Mettler Toledo

Date of Calibration: 26 June 2023

Page 4 of 5

Location: Chemical Calibration Laboratory, National Food Institute

Environment Condition:

Ambient Temperature (24.4 ± 1.0) °C

Relative Humidity (54 ± 2) %

Condition of this results of Calibration:

- Calibration Method :
 - In house method: W-TE-025 by comparison with standard thermometer.
 - The Calibration is determined by comparing with a known temperature from a standard resistance thermometer.
 - The temperature scale in use at this laboratory is the International Temperature scale of 1990 (ITS-90).

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
HANDHELD THERMOMETER	1523	2933097	PSL-T 1282/65	03-Nov-23	TISTR
Platinum Resistance Thermometer (PRT)	5627A	923972			

Support Equipment : - Low Temperature Bath (ISOCAL-6), Model: Europa-6 Plus Basic, S/N: 341592/2

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.

6. Condition of Calibrated item : Good

7. Result of Calibration :



Without adjustment



After adjustment

P. Janghachit

27 June 2023



Calibration Report

Certificate No.: 2303560-001-01

Equipment: Digital Thermometer with RTD (pH Meter)

Resolution: 0.1 °C Model: Seven Compact S220

Serial No.: C113432421 ID No.: UAE.WAT.009/2564

Manufacturer: Mettler Toledo

Date of Calibration: 26 June 2023

Page 5 of 5

Calibration point: 15.0, 25.0 and 35.0 °C

Calibration result:

- The probe was immersed in liquid bath or dry bath to a minimum depth of 100 mm.

- Description of probe, model : HI11310 S/N : 078743

Dimension of probe : Diameter 12 mm., Length 175 mm.,

Sheath material : Plastic

UUC* Reading (°C)	Standard Temperature (°C)	Correction Value (°C)	Uncertainty ± (°C)
15.0	15.003	0.0	0.099
24.9	25.005	0.1	0.099
34.9	35.005	0.1	0.099

Note - UUC* : Unit Under Calibration

P. Pengbunt
27 June 2023

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65






TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23MM113
Page.: 1 of 3

Certificate of Calibration

Equipment :	Electronic Balance
Manufacturer :	Mettler Toledo
Model :	XSR205
Serial No. :	C210685394
ID No. :	UAE.WAO.010/2565
Submitted by :	United Analyst and Engineering Consultant Co.,Ltd. 3 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phakhanong, Bangkok 10260
Location :	Balance Room
Received order :	26 April 2023
Calibration Date :	26 April 2023
Ambient Temperature :	15 °C to 40 °C
Relative Humidity :	30 % to 90 %
Calibrated by :	Man Pattanapongpaiboon
Approved by :	 Approved Signatory
() Pornthippa Tameyakul	
() Malee Butkruea	
(✓) Suwit Imjai	
Issue Date :	2 May 2023

The Uncertainties are for a confidence probability of approximately 95%

This certificate may not be reproduced other than in full, except with the prior written
Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0053700



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2
Procedure used :-

Cert.No.: 23MM113

Page: 2 of 3

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

Instruments	Model	Serial No.	ID No.	Test report No.	Due date
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024

- This certificate is valid only to the item calibrated on date and place of calibration.
- This result of calibration was made on requested at the point specified by customer.
- This certificate is not certified for any commercial transaction.
- This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity :	0 g to 81 g	Resolution	0.00001 g
	81 g to 220 g	Resolution	0.0001 g

Before Adjustment :

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
80	79.99992	+0.00008	0.15	2.00
200	199.9995	+0.0005	0.29	2.00

After Adjustment :

1. **Determination of the standard deviation of weighing machine** (n = 10)

Applied Weight (g)	Standard Deviation of Reading (g)
80	0.000007
200	0.00004

เอกสารไม่ควบคุม



Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0459OC-2

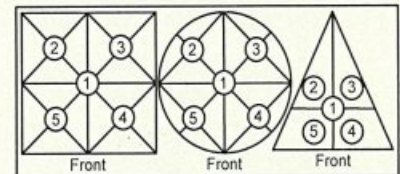
Cert.No.: 23MM113

Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 100 g was placed to various position on the pan.
The weighing machine reading error obtained is given in the table



Maximum difference between
off-center and central loading
(g)
0.0001

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)
-0.0001	-0.0001	0.0000	-0.0001	-0.0001

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (\pm mg)	Coverage Factor (k)
Unload	0.00000	0.00000	0.014	2.11
0.05	0.04999	+0.00001	0.015	2.09
0.1	0.09999	+0.00001	0.015	2.07
1	1.00000	0.00000	0.018	2.04
5	5.00000	0.00000	0.026	2.00
20	20.00002	-0.00002	0.045	2.00
50	50.00002	-0.00002	0.080	2.00
80	80.00002	-0.00002	0.15	2.00
100	100.0000	0.0000	0.17	2.00
150	150.0000	0.0000	0.29	2.00
200	199.9999	+0.0001	0.29	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

-o0o-

เอกสารไม่ควบคุม

a 1159271

Calibration Certificate

Certificate No.: 2400141-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 3

Equipment: CHAMBER (Hot Air Oven)

Manufacturer: MEMMERT

Model: UF 55

Serial No.: B216.1666

ID No.: UAE.WAO.027/2559


Order No.: 2400141

Operation No.: 2400141-001

Date of Receipt: 11 October 2023

Date of Calibration: 11 October 2023

Calibrated by Mr.Worapob Sooktong
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 16 October 2023

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2400141-001-01

Equipment: CHAMBER (Hot Air Oven)

Model: UF 55 Serial No.: B216.1666

Resolution: 0.1 °C ID No.: UAE.WAO.027/2559

Manufacturer: MEMMERT

Date of Calibration: 11 October 2023

Page 2 of 3

Location: Laboratory, Floor 2, UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Environment Condition:
Ambient Temperature (28 ± 1) °C
Relative Humidity (63 ± 2) %
Line Voltage (228 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 9 standard thermometer into its chamber and calibration according to W-TE-014 Based on TLAS G-20-1/02-08 (E): Guidelines for Calibration and Checks of Temperature Controlled Enclosures.
- The temperature scale used was based on ITS - 90.
- All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No./ID No.	Certificate No.	Due Date	Through
Digital Thermometer with sensor	34972A	MY49016894	TE 660380-01	22 April 2024	NATIONAL FOOD INSTITUTE
	RTD	CH#201-209/ RTD#201-209			

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- Condition of Calibrated item : Good

UUC Description :

Time of Record 1 Hour 9 Minute At 104.0, 140.0 and 180.0 °C
Fresh air Damper ☐ Open Position ☐
☒ Close
☐ Not Available

7. Result of Calibration : ☒ Without adjustment ☐ After adjustment



Calibration Report

Certificate No.: 2400141-001-01
Equipment: CHAMBER (Hot Air Oven)
Model: UF 55 Serial No.: B216.1666
Resolution: 0.1 °C ID No.: UAE.WAO.027/2559
Manufacturer: MEMMERT

Date of Calibration: 11 October 2023

Page 3 of 3

Calibration point: 104.0, 140.0 and 180.0 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
MIN	28.2	61.4	227.4
MAX	28.3	65.1	229.3

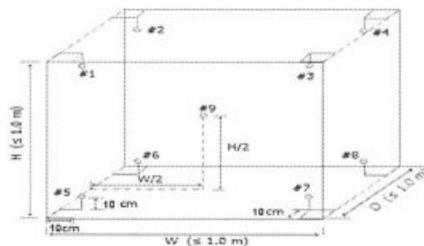


Table1 : Reporting of Temperature

Calibration point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.9 is REF)									Uncertainty ± (°C)
	# 1	# 2	# 3	# 4	# 5	# 6	# 7	# 8	# 9	
104.0	104.05	103.98	104.02	104.08	104.00	104.05	103.99	104.17	104.00	0.53
140.0	140.09	139.99	139.91	140.05	139.99	139.91	139.97	140.26	139.97	0.73
180.0	180.46	180.33	180.25	180.28	180.33	179.96	180.31	180.64	180.16	0.90

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* reading (°C)			Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	MIN	MAX	Average			
104.0	104.0	104.0	104.0	0.090	0.18	0.38
140.0	140.0	140.1	140.0	0.075	0.28	0.47
180.0	180.0	180.1	180.0	0.13	0.48	0.88

Note The quoted uncertainty include " Stability " and " Loading effect (20% of Temp Uniformity) "

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor $k = 2$, providing a level of confidence of approximately 95 %.

----- End -----

Handwritten signature




Calibration Certificate

Certificate No.: 2302827-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: XSR204
Serial No.: C117635043
ID No.: UAE.WAS.012/2564
Order No.: 2302827
Operation No.: 2302827-001
Date of Receipt: 10 May 2023
Date of Calibration: 10 May 2023

Calibrated by Mr.Manas Somsak
Specialist

Approved by 
(Mr.Pheraphat Tuanjit)

Manager, Division of Calibration Laboratory

Date of Issue: 18 May 2023

Responsible for the Technical Management Team

The uncertainties are for a confidence probability of approximately 95%

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation Scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 10 May 2023

Page 2 of 4

Environment Condition: Ambient Temperature 21.4 ± 0.2 °C Relative Humidity: 43.4 ± 0.9 %

Place of Calibration: Balance room (Water Analysis Unit), UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.

Condition of Equipment: Good Condition

Condition of This Results of Calibration:

1. Calibration Method: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	B505567572	TCS	M2304053S	8 April 2024

Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR23-0489	21 February 2024

3. This certification is traceable to SI UNIT

4. This certificate was certified only for the instrument we calibrated.

5. This result of calibration was found accurate as shown on date and place of calibration only.

Calibration Results:

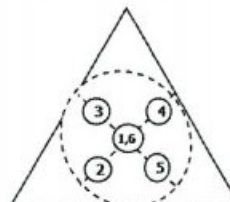
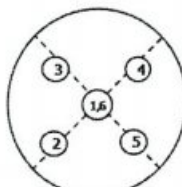
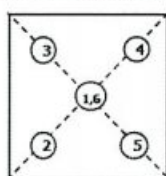
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
100	0.000032
200	0.000032

2. Off-Center Error:

A mass of 100 g was placed and moved to various position on pan.

The balance reading obtained is given in the table.



1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0002	100.0002	100.0002	100.0002	100.0003	100.0002	0.0001

F-CS-012 Revision: 01 Date: 20-04-65

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Calibration Report

Certificate No.: 2302827-001-01

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 10 May 2023

Page 3 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unload	0.00000	0.0000	0.0000	0.000085	2.00
0.01	0.01000	0.0100	0.0000	0.000085	2.00
0.02	0.02001	0.0200	0.0000	0.000085	2.00
0.05	0.05000	0.0500	0.0000	0.000085	2.00
0.1	0.10001	0.1000	0.0000	0.000085	2.00
0.2	0.20001	0.2000	0.0000	0.000085	2.00
0.5	0.50002	0.5000	0.0000	0.000085	2.00
1	1.00000	1.0000	0.0000	0.000086	2.00
2	2.00002	2.0000	0.0000	0.000086	2.00
3	3.00003	3.0000	0.0000	0.000087	2.00
5	5.00002	5.0000	0.0000	0.000087	2.00
10	10.00001	10.0000	0.0000	0.000088	2.00
20	20.00003	20.0000	0.0000	0.000092	2.00
30	30.00004	30.0000	0.0000	0.000098	2.00
40	40.00007	40.0000	0.0000	0.00011	2.00
45	45.00009	45.0001	0.0000	0.00013	2.00

F-CS-012 Revision: 01 Date: 20-04-65

RT

Calibration Report

Certificate No.: 2302827-001-01

Equipment:

Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR204

Resolution: 0.0001 g

Serial No.: C117635043

ID No.: UAE.WAS.012/2564

Capacity: 220 g

Date of Calibration: 10 May 2023

Page 4 of 4

Calibration Results: (Continued)

Calibration Range: 0 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value:

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
50	50.00003	50.0000	0.0000	0.00011	2.00
55	55.00005	55.0000	0.0000	0.00012	2.00
60	60.00004	60.0000	0.0000	0.00012	2.00
65	65.00005	65.0000	0.0000	0.00013	2.00
70	70.00006	70.0001	-0.0001	0.00013	2.00
75	75.00008	75.0002	-0.0001	0.00013	2.00
80	80.00007	80.0002	-0.0001	0.00014	2.00
85	85.00009	85.0002	-0.0001	0.00014	2.00
90	90.00010	90.0002	-0.0001	0.00015	2.00
100	100.00006	100.0002	-0.0001	0.00016	2.00
120	120.00009	120.0002	-0.0001	0.00018	2.00
150	150.00009	150.0002	-0.0001	0.00021	2.00
200	200.00016	200.0003	-0.0001	0.00028	2.00

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

----- End -----

F-CS-012 Revision: 01 Date: 20-04-65






TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 23TM249

Page : 1 of 3

Certificate of Calibration

Equipment : BOD Incubator

Manufacturer : Arco

Model : UC4-1320

Serial No. : 13URC4S013201

ID No. : UAE.WAO.015/2561

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Lab Floor 2

Received Order : 15 February 2023
Calibration Date : 15 February 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :

Approved Signatory

- () Pornthippa Tameyakul
(✓) Malee Butkruea
() Suwit Imjai

Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

เอกสารไม่ควบคุม

A 0051476



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1

Cert. No.: 23TM249

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34972A	MY57013711	22LM93	02 Jul 2023

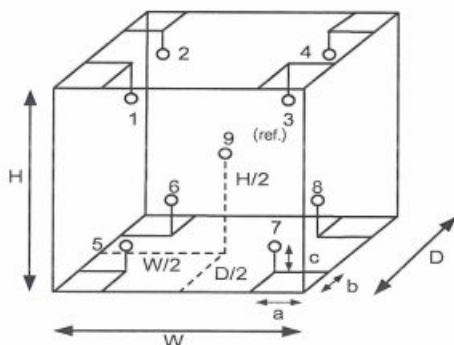
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available



Environment during calibration		
	Beginning	Finished
Temp. (°C)	29	31
REL.Humid. (%)	63	67
AC Supply (Volt)	220	220

Position :	Ref. Std. ID No.:
1	22-18RTD-2/1
2	18RTD-2/2
3	18RTD-2/3
4	18RTD-2/4
5	18RTD-2/5
6	18RTD-2/6
7	18RTD-2/7
8	18RTD-2/8
9 (ref.)	18RTD-2/9

Probe Installation Details :

a = 10 cm
b = 10 cm
c = 10 cm

Dimension of Chamber :

D = 0.62 m
W = 1.2 m
H = 1.2 m
Capacity = 0.89 m³

เอกสารไม่ควบคุม *Malu*



Equipment : BOD Incubator
Condition As-Received : Used Item
Reference : 2302-0297OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM249

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
20.0	20.0	19.3	0.32	0.57	1.0	0.60	2

Calibration Point (°C)	Measured Temperature (°C)								
	Position								
	1	2	3	4	5	6	7	8	9 (ref.)
20.0	20.086	19.916	20.386	19.976	19.973	19.838	19.837	19.821	19.949

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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เอกสารไม่ควบคุม

a 1149512

CERT.No.: HS-U012C

Calibration Date : 1 Mar 23	Model : YSI 5100
Submitted by : United Analyst and Engineering Consultant Co., Ltd.	S/N : 11B101863
3 Soi Udomsuk 41, Sukhumvit Road, Bangchak,	Probe : YSI 5010
Phrakhanong, Bangkok.(Head office)	S/N : 22B100125
	ID NO. : -
Avg Room Temp : 20 °C	Air Temp ref : S/N. E00522
Avg Water Temp : 20 °C	Barometric ref : S/N. E00522
Air Pressure : 760.00 mmHg	Water Temp ref : S/N. 11431
Salinity : 0 ppt	
	Technician : Kittipong M.

Calibration Details

Calibration Point	100% air sat. (@20 °C, DO = 9.09 mg/l)	(status)	(status)
Measurement 1 (mg/l)	9.09	(PASS)	-
Measurement 2 (mg/l)	9.09	(PASS)	-
Measurement 3 (mg/l)	9.09	(PASS)	-
Measurement 4 (mg/l)	9.09	(PASS)	-
Measurement 5 (mg/l)	9.09	(PASS)	-
Measurement 6 (mg/l)	9.09	(PASS)	-
Measurement 7 (mg/l)	9.08	(PASS)	-
Measurement 8 (mg/l)	9.09	(PASS)	-
Measurement 9 (mg/l)	9.08	(PASS)	-
Measurement 10 (mg/l)	9.09	(PASS)	-

Mean Measurement	9.09	mg/l	-	-
Inaccuracy	0.00	mg/l	-	-

Overall Status (PASS)

Manufacturer Specification

Accuracy = +/- 0.02 mg/l

- 1) This certificate is issued based on the result that are found as shown on date and place of test only.
- 2) The calibration procedure followed in accordance with Harikul Science Co., Ltd.
- 3) This result shall not be used for advertising purpose.



Technician Signature
 (Kittipong Maekwong)



เอกสารไม่ควบคุม Laboratory Manager
 (Supreecha Sumaritam)



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
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Cert. No.: 23TM378

Page : 1 of 3

Certificate of Calibration

Equipment : Incubator

Manufacturer : Memmert

Model : IPP 260

Serial No. : V615.0187

ID No. : UAE.MIC.003/2559

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 11 April 2023

Calibration Date : 12 April 2023

Ambient Temperature : (26 ± 10) °C

Relative Humidity : (50 ± 30) %

Calibrated by : Preecha Hlahib

Approved by :

Malee

Approved Signatory

() Pornthippa Tameyakul
(/) Malee Butkruea
() Suwit Imjai

Issue Date :

24 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1

Cert. No.: 23TM378

Page : 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Model	Serial No.	Cert. No.	Due Date
1) Data Acquisition	34972A	MY49001451	23LM27	25 Feb 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

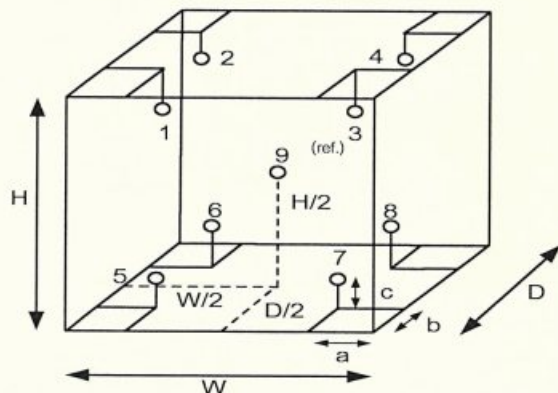
Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

Fresh air setting : Not Available

Environment during calibration

	Beginning	Finished
Temp. (°C)	25	26
REL.Humid. (%)	57	61
AC Supply (Volt)	220	220



Position :	Ref. Std. ID No.:
1	19RTD-2/1
2	19RTD-2/2
3	19RTD-2/3
4	19RTD-2/4
5	19RTD-2/5
6	19RTD-2/6
7	19RTD-2/7
8	19RTD-2/8
9 (ref.)	19RTD-2/9

Probe Installation Details :

a = 5.0 cm
b = 5.0 cm
c = 5.0 cm

Dimension of Chamber :

D = 0.50 m
W = 0.64 m
H = 0.80 m
Capacity = 0.26 m³

เอกสารไม่ควบคุม



Equipment : Incubator
Condition As-Received : Used Item
Reference : 2304-0155OC-1
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Not Available

Cert. No.: 23TM378

Page : 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor <i>k</i>
35.0	35.0	35.0	0.052	0.53	0.60	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	Position									
	1	2	3	4	5	6	7	8	9 (ref.)	
35.0	35.092	35.148	34.817	35.149	34.894	35.323	34.773	35.058	34.802	0.30

Average* : The average of 30 values in each position.

Temperature stability : One-half of the greatest maximum difference of measured temperature at any one sensor.

Temperature uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Overall Variation : The Difference of the maximum and minimum measured temperatures throughout observation.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity .

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert. No.: 23TM193

Page : 1 of 3

Certificate of Calibration

Equipment : Water Bath

Manufacturer : Memmert

Model : WNE 14

Serial No. : L416.0606

ID No. : UAE.MIC.002/2560

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Microbiology Laboratory

Received Order : 15 February 2023
Calibration Date : 15 February 2023
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %

Calibrated by : Suwit Imjai

Approved by :

Approved Signatory

() Pornthippa Tameyakul
(/) Malee Butkruea

Issue Date : 24 February 2023

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Corporate Services 3 : Equipment Calibration and Testing Services.

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2302-0295OC-2

Cert. No.: 23TM193

Page : 2 of 3

Procedure Used :-

Calibration were conducted using in-house calibration procedure CP-OT04 according to direct measurement method with Data Acquisition which connected with Industrial Platinum Resistance Thermometer (IPRT).

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

<u>Instrument</u>	<u>Model</u>	<u>Serial No.</u>	<u>Cert. No.</u>	<u>Due Date</u>
1) Data Acquisition	34972A	MY59003411	22LM165	26 Nov 2023

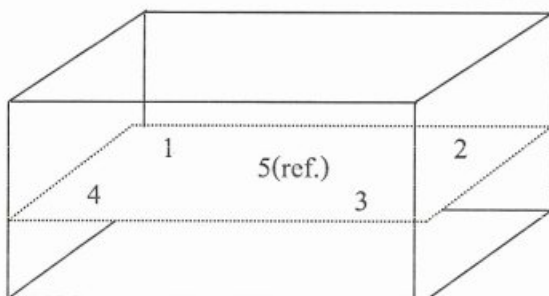
2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This certification is traceable to the International System of Unit.

Result of Calibration :- (*) Without Adjustment

Function of UUC* : Temperature Source

	Environmental		AC Voltage Supply
	(°C)	(%R.H.)	(Volt)
Beginning of Calibration	22	65	231
Finished of Calibration	23	61	231



Front

Position :	Ref. Std. ID No.:
1	4804539-001
2	4804539-002
3	4804539-003
4	4804539-004
5(ref.)	4804539-005

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Equipment : Water Bath
Condition As-Received : Used Item
Reference : 2302-0295OC-2
Result of Calibration :- (*) Without Adjustment
Function of UUC* : Temperature Source

Cert. No.: 23TM193

Page : 3 of 3

Calibration point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Average* Standard Reading (°C)				
			Position				
			1	2	3	4	5 (ref.)
44.5	44.5	44.5	44.453	44.437	44.428	44.477	44.459

Calibration point (°C)	Uniformity (°C)	Stability (± °C)	Uncertainty (± °C)	Coverage Factor <i>k</i>
44.5	0.079	0.038	0.15	2

Average* : The average of 30 values in each position.

Uniformity : The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time or at as close an observation time as possible to determine the temperature pattern or homogeneity within the chamber under steady-state conditions.

Stability : One-half of the greatest maximum difference of measured temperature at any one probe.

UUC* : Unit Under Calibration

Note : The reported uncertainty of measurement was included stability and excluded uniformity.

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor *k*, providing a level of confidence of approximately 95 %.

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Calibration Certificate

Certificate No.: 2304203-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhnong, Bangkok 10260

Page 1 of 3

Equipment: Autoclave
Manufacturer: ALP
Model: CL-40L
Serial No.: 807298
ID No.: UAE.MIC.019/2560
Order No.: 2304203
Operation No.: 2304203-001
Date of Receipt: 10 August 2023
Date of Calibration: 10 August 2023

Calibrated by Mr.Worapob Sooktong
Scientist

Approved by 
(Mr.Pheraphat Tuanjit)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team

Date of Issue: 15 August 2023

The uncertainties are for a confidence probability of approximately 95 %.

This Certificate is issued in accordance with the conditions of accreditation granted by the Thai Laboratory Accreditation scheme which has assessed the measurement capability of the laboratory and its traceability to recognized national standards and to the units of measurement realized at the corresponding national standards laboratory. This certificate may not be reproduced other than in full except with the prior written approval of the National Food Institute.

F-CS-009 Revision: 01 Date: 20-04-65



Calibration Report

Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP
Date of Calibration: 10 August 2023

Page 2 of 3

Location: 301, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Environment Condition: Ambient Temperature (28 ± 1) °C
Relative Humidity (65 ± 2) %
Line Voltage (225 ± 1) Volt

Condition of this results of Calibration:

- This instrument was calibrated by insert 3 standard temperature recorder with RTD into its autoclave and calibration according to W-TE-018 based on BS 2646-1(2021) : Autoclaves for sterilization in laboratories Design, construction, safety and performance Specification.
 - The temperature scale used was based on ITS - 90.
 - All data show below were final values and the initial data may be obtained upon request.

2. Reference Standard Instrument :

Instrument	Model	Serial No.	Certificate No.	Due Date	Through
Digital Thermometer with RTD (Data Logger)	HiTemp140-2	S25601	NC-22-11-22-176	9-Nov-23	MADGETECH INC.
	HiTemp140-2	S25602	NC-22-11-22-175	9-Nov-23	MADGETECH INC.
	HiTemp140-2	R54918	TE 660383-01	8-Apr-24	NATIONAL FOOD INSTITUTE

- This certificate is traceable to International System of Units (SI Units).
- This certificate was certified only for the instrument we calibrated.
- This result of calibration was found accurate as shown on date and place of calibration only.
- This standard does not apply to sterilizers or disinfectors used for medical, dental, pharmaceutical.
- Condition of Calibrated item : Good

UUC Description : Setting program function sterilization : STERILIZE/NORMAL

Time of sterilization 15 Minute At 121 °C

8. Result of Calibration :
- | | |
|-------------------------------------|--------------------|
| <input checked="" type="checkbox"/> | Without adjustment |
| <input type="checkbox"/> | After adjustment |




Calibration Report

Certificate No.: 2304203-001-01
Equipment: Autoclave
Model: CL-40L Serial No.: 807298
Resolution: 1 °C ID No.: UAE.MIC.019/2560
Manufacturer: ALP

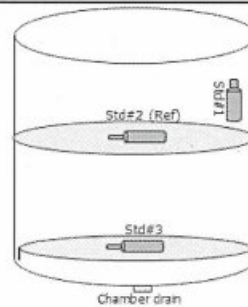
Date of Calibration: 10 August 2023

Page 3 of 3

Calibration point: 121 °C

Calibration result:

Calibration Condition	Temperature (°C)	Relative Humidity (%)	Line Voltage (Volt)
Min	27.0	63.5	223.3
Max	28.3	67.3	225.9



Standard at Position

Std#1 = Attached to the load temperature probe, within 20 mm.
Std#2 = In the upper half of the chamber
Std#3 = In the chamber drain, within 100 mm.

Table1 : Reporting of Temperature

Calibration Point (°C)	Measured Temperature (°C) @ Sensor No. (Sensor No.2 is REF)			Uncertainty ± (°C)
	Std.# 1	Std.# 2 (Ref)	Std.# 3	
121	121.68	121.70	121.66	0.66

Table 2 : Reporting of Characterization Result

UUC* Setting (°C)	UUC* Reading				Stability ± (°C)	Uniformity (°C)	Overall Variation (°C)
	Min (°C)	Max (°C)	Average (°C)	MPa			
121	121	121	121	0.10	0.11	0.12	0.23

Note

The quoted uncertainty include " Stability " and " Loading effect (20% of Uniformity)"

UUC* = Unit Under Calibration

Stability = One-half of the greatest maximum difference of measured temperatures at any one sensors, for at least half an hour after reaching steady state.

Uniformity = The maximum difference of measured temperatures at any sensors and the measured temperature at the reference location which are observed at the same time.

Overall Variation = The difference of the maximum and minimum measured temperatures throughout observation time.

The report uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k= 2, providing a level of confidence of approximately 95 %.

----- End -----

Handwritten signature





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TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 23MM150

Page.: 1 of 3

Certificate of Calibration

Equipment : Electronic Balance

Manufacturer : Mettler Toledo

Model : MS603S /01

Serial No. : B007010311

ID No. : UAE.TOX.008/2553

Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260

Location : Balance Room 2

Received order : 07 April 2023

Calibration Date : 07 April 2023

Ambient Temperature : 15 °C to 40 °C

Relative Humidity : 30 % to 90 %

Calibrated by : Suwit Imjai

Approved by : 
Approved Signatory

(/) Pornthippa Tameyakul
(/) Malee Butkruea

Issue Date : 10 April 2023

The Uncertainties are for a confidence probability of approximately 95%

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Equipment : Electronic Balance
Condition As-Received : Used Item
Reference : 2304-0016OC-1

Cert.No.: 23MM150

Page: 2 of 3

Procedure used :-

Calibration were conducted using in-house calibration procedure CP-OB01 according to direct measurement method against standard weight.

Condition of this result of calibration

1. Reference standard instruments:-

<u>Instruments</u>	<u>Model</u>	<u>Serial No.</u>	<u>ID No.</u>	<u>Test report No.</u>	<u>Due date</u>
1) Standard Weight Set (E2)	15884	24053	70RC007	MM-0010-22	20 Jan 2024
2) Standard Weight (E2)	158471	-	70RC197	MM-0059-22	25 Apr 2024

2. This certificate is valid only to the item calibrated on date and place of calibration.

3. This result of calibration was made on requested at the point specified by customer.

4. This certificate is not certified for any commercial transaction.

5. This certification is traceable to the International System of Unit.

Result of calibration () Without Adjustment (*) After Adjustment by Internal Calibration

Range capacity : 0 g to 620 g Resolution 0.001 g

Before Adjustment :

<u>Applied Weight</u>	<u>Balance Reading</u>	<u>Correction</u>	<u>Measurement Uncertainty</u>	<u>Coverage Factor</u>
(g)	(g)	(g)	(\pm mg)	(k)
300	299.999	+0.001	1.4	2.07
600	599.997	+0.003	1.7	2.09

After Adjustment :

1. **Determination of the standard deviation of weighing machine** (n = 10)

<u>Applied Weight</u>	<u>Standard Deviation of Reading (g)</u>
(g)	
300	0.0006
600	0.0008

เอกสารไม่ควบคุม



Equipment : Electronic Balance
 Condition As-Received : Used Item
 Reference : 2304-0016OC-1

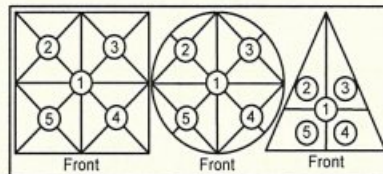
Cert.No.: 23MM150

Page: 3 of 3

Result of calibration

2. Effect of off center loading

A mass of 200 g was placed to various position on the pan.
 The weighing machine reading error obtained is given in the table



Maximum difference between
 off-center and central loading

Position 1 (g)	Position 2 (g)	Position 3 (g)	Position 4 (g)	Position 5 (g)	(g)
-0.001	+0.001	+0.001	-0.002	-0.002	0.002

3. Departure from nominal value

Applied Weight (g)	Balance Reading (g)	Correction (g)	Measurement Uncertainty (± mg)	Coverage Factor (k)
Unload	0.000	0.000	1.3	2.09
0.5	0.499	+0.001	1.3	2.09
1	0.999	+0.001	1.3	2.09
50	50.000	0.000	1.3	2.09
100	99.999	+0.001	1.3	2.09
150	149.999	+0.001	1.3	2.09
200	199.999	+0.001	1.3	2.09
300	299.999	+0.001	1.4	2.07
400	399.999	+0.001	1.6	2.11
500	500.000	0.000	1.7	2.11
600	599.999	+0.001	1.7	2.09

The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k , providing a level of confidence of approximately 95 %.

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