

ภาคผนวก ง
เอกสารสอบเทียบเครื่องมือ

CERTIFICATE OF CALIBRATION

Certificate No. : CL-003-65

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Orifice
MANUFACTURER : Tach Environmental, Inc.
MODEL/TYPE : TE-5025A
SERIAL NUMBER : 33883
ID NUMBER : UAE-EFM-023/2560
CONDITION AS-RECEIVED : Used item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

Calibration procedure:
The Orifice gas flow device was calibrated against Standard Rotary Displacement Meter (Roche). After Model G65 (GAC/2424), the 100.000 was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the measurement to recognized national standards used to calibrate the international system of units (SI) through the VSL (National Metrology Institute of Netherlands) via Certificate number: 0228591

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"

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

ENVIRONMENTAL CONDITIONS:

Ambient condition in the laboratory are as follows:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1020 ± 3.0 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.

MEASUREMENT RESULTS:

The Orifice gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roche 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	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Qs] 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	1.649	0.913
3	1.118	754.323	24.730	24.210	41.325	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	7.625	1.735	1.361

Slope (m): 2.04804

Intercept (b): -0.01593

Correlation coefficient (r): 0.99982

Uncertainty (k=2): 0.011 m³/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	Ap_meter mmHg	Ap_Orifice inH ₂ O	γ	Standard Flow [Qs] 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	41.325	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	7.625	1.735	1.361

Slope (m): 1.28277

Intercept (b): -0.01223

Correlation coefficient (r): 0.99982

Uncertainty (k=2): 0.012 m³/min

End of Certificate of Calibration

Calibrated by:
Mr. Sowan Thachalad
Ms. Jitraporn Lertsomphol



Approved signatory: Mr. Parin
Calibration Department Manager



THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION IS GIVEN IN WRITING FROM THE LABORATORY เอกสารไม่ควบคุม

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PHITANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL. 0-2717-0000-34 FAX. 0-2719-8488

Certificate of Calibration

Certificate No. : 23P1401
Page : 1 of 2

Equipment : U-Tube Manometer
Manufacturer: Dwyer
Model : 1221-36-WM
Serial No.: -
ID No.: UAE-EFM-022/2560
Condition As-Received: Used Item
Received Date: 26 April 2023
Calibration Date: 08 May 2023
Reference: 2304-0703W/C
Ambient Temperature: (23 ± 2) °C
Relative Humidity: (50 ± 15) %
Atmospheric Pressure: 1010 mbar
Submitted by: United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok,
Phrakhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using "DKD-R 6-1: Calibration of Pressure Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Pressure Calibrator	PC106P	1189	MP-0137-22	24 Aug 2023

2. This result of calibration was made on requested at the point specified by customer.
3. Scale and conversion factor is 1 kPa = 4.0146293 inH₂O
4. This instrument was used clean air and oil as pressure media.
5. This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.
6. This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
7. The certificate is valid only to the item calibrated on date and place of calibration.
8. This Certification is traceable to the International System of Unit maintained through:-
National Institute of Metrology Thailand (NIMT)

Calibrated by : Suvit Aummanee
Issue Date : 11 May 2023

Approved Signatory :
Phaninee Prabpapai
Sura Suwanmanee
Attaporn Panurach

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Cert.No.: 23P1401
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

Range: 0 inH₂O to 36 inH₂O
Scale Interval: 0.1 inH₂O (The Fifth Estimate)

Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.00	-6.00	12.00	0.00
14.00	7.00	-7.00	14.00	0.00
16.00	8.00	-8.00	16.00	0.00
18.00	9.00	-9.00	18.00	0.00
20.00	10.00	-10.00	20.00	0.00
22.00	11.00	-11.00	22.00	0.00
24.00	12.02	-12.00	24.02	0.02
26.00	13.02	-13.00	26.02	0.02
28.00	14.02	-14.00	28.02	0.02
30.00	15.04	-15.00	30.04	0.04
32.00	16.04	-16.00	32.04	0.04
34.00	17.02	-17.00	34.02	0.02
36.00	18.00	-17.96	35.96	0.16

The uncertainty of measurement was ± 0.11 inH₂O
* UUC = Unit Under Calibration
* ΔP = High-port side - Low-port side
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

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Certificate of Calibration

Certificate No.: 23P1858
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.124/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakhong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4. This result of calibration instrument was in absolute pressure.

5. This instrument was used clean air as pressure media.

6. The certificate is valid only to the item calibrated on date and place of calibration.

7. This Certification is traceable to the International System of Unit maintained through:-

-National Institute of Metrology Thailand (NIMT)

Calibrated by: Suksan Khankeaw
Issue Date: 08 June 2023

Approved Signatory:
[] Phatinee Prabpaipal
[] Sura Suwanasri
[x] Attapol Panurach

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Result of calibration:- Without adjustment

Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa

Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.93	970.47	981.93	991.32	1002.29	1011.64	1021.14	1032.30
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.29	-1.64	-1.14	-2.30

Decreasing Pressure

Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.36	992.35	981.94	970.49	959.94
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	0.06

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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except with the prior written approval of the head of
Corporate Services 3: Equipment Calibration and Testing Services.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakhong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23105	15 Mar 2024

2. The 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 maintained through:-

-National Institute of Standards and Technology (NIST) , The United States of America

-Technology Promotion Association (Thailand-Japan), NSO-ONSG Accredited No. Calibration 0008

Calibrated by: Somchai Dumvor
Issue Date: 07 June 2023

Approved Signatory:
[x] Chakrit Waowwanjua
[] Ponthipha Tameyakul
[] Viporn Tantiyawutti

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Result of Calibration:-

Function:- Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.8
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:-

Function:- Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	3.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:-

Function:- Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was base on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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MULTI-POINT GAS TEST REPORT

Test Date : Jan 24, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778106

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8	PPM		
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

Dilutor Detail

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	101.6	1.60	1.57
Level 3	40.00%	200.0	201.2	1.20	0.60
Level 4	60.00%	300.0	301.3	1.30	0.43
Level 5	80.00%	400.0	400.0	0.00	0.00

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

Multi-Point Gas Test Chart

Calculate by : 24/1/2023
Approve by : 24/Jan/2023

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MULTI-POINT GAS TEST REPORT

Test Date : Feb 22, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8	PPM		
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

Dilutor Detail

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	101.7	1.70	1.67
Level 3	40.00%	200.0	201.2	1.20	0.60
Level 4	60.00%	300.0	301.0	1.00	0.33
Level 5	80.00%	400.0	400.0	0.00	0.00

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

Multi-Point Gas Test Chart

Calculate by : 22/2/2023
Approve by : 22/Feb/2023

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: EBO143262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
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 Gases Calibration Standards (May 2012) document EPA 8200-12-031, 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 ppb, i.e. 5.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	$\pm 1.4\%$ NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	$\pm 1.4\%$ NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.95 PPM	G1	$\pm 1.0\%$ NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	$\pm 0.7\%$ NIST Traceable	09/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	12380	CC706068	40.82 PPM NITRIC OXIDE/NITROGEN	$\pm 1.5\%$	Feb 02, 2026
PRM	12380	D865025	9.91 PPM NITROGEN DIOXIDE/AIR	$\pm 2.5\%$	Feb 02, 2026
GMIS	40142383102	CC050581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	$\pm 2.1\%$	Jun 18, 2023
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	$\pm 0.8\%$	Jun 17, 2022
NTRM	14060119	CC434277	980.8 PPM CARBON MONOXIDE/NITROGEN	$\pm 0.6\%$	Nov 15, 2025

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 NO ₂	FTIR	Jun 03, 2021
Nicolet 6700 AHR0801333 SO ₂	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.

Approved for Release



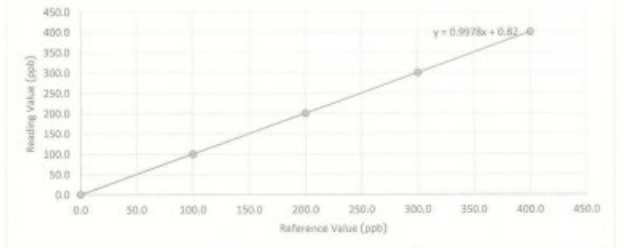
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MULTI-POINT GAS TEST REPORT			
Equipment	Gas Analyzer (SO ₂)	Model	43i
Manufacturer	Thermo Scientific	Serial Number	CM22387066
Std. gas Concentration		Dilutor Detail	
Sulphur Dioxide (SO ₂)	44.68	Manufacturer	Thermo Scientific
Nitric Oxide (NO)	45.94	Model	146i
Carbon Monoxide (CO)	984.8	Serial Number	1180540071
Cylinder No.	EB01432	Expiration Date	June 21, 2024

SO ₂ Multi-Point Calibration							
Point	%	Ref. Value (ppb)	Read. SO ₂ (ppb)	Difference Error	Percent Error	[% Error]	Res. Time (min.)
Level 1	Zero	0.0	1.0	1.00	1.00	1.00	5
Level 2	20	100.0	100.2	0.20	0.20	0.20	5
Level 3	40	200.0	201.7	1.70	0.85	0.85	5
Level 4	60	300.0	301.3	1.30	0.43	0.43	5
Level 5	80	400.0	400.0	0.00	0.00	0.00	5
R		Slope	Intercept	Average			
		1.000	0.999	1.020	Criteria	5.00	10



Calibrate by: [Signature]
 Calibration Date: 7/9/22
 Approve by: [Signature]
 Approved Date: 8 Aug 2023

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CERTIFICATE OF ANALYSIS

Grade of Product: EPA Protocol

Part Number: E04N199E16A0103
 Cylinder Number: EB0143262
 Laboratory: 124 - Durham (SAP) - NC
 PGVP Number: B22021
 Gas Code: CO,NO,NOX,SO₂,BALN
 Reference Number: 122-402135167-1
 Cylinder Volume: 144.4 CF
 Cylinder Pressure: 2015 PSIG
 Valve Outlet: 860
 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 800R-12/931, using the assay procedures listed. Analytical Methodology does not require correction for analytical interference. This cylinder has a total analytical uncertainty of stated below with a confidence level of 95%. There are no significant impurities which affect the use of this calibration module. All concentrations are on a mole/mole basis unless otherwise noted.
 Do Not Use This Cylinder below 100 psig, i.e. 6.7 megapascals.

ANALYTICAL RESULTS					
Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.36 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	44.98 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
NTRM	20081120	CC708086	40.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.5%
PRM	12385	D365025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.0%
GMIS	401423838102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1%
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%
NTRM	14080119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%

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.

Approved for Release



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Certificate of Calibration

WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.
 Serial No.: 2205070114
 Calibration Date: 2022/9/14
 Calibration Expiry Date: 2023/9/13

The Result of Calibration

Velocity				
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result
1.0	1.0	0.0	0.9-1.1	Pass
1.9	2.0	0.1	1.8-2.2	Pass
5.1	5.0	0.1	4.7-5.3	Pass
7.0	7.0	0.0	6.5-7.5	Pass
10.1	10.0	0.1	9.5-10.5	Pass
19.6	20.0	0.4	19.0-21.0	Pass

Wind Direction				
Measured Value	Actual Value	Deviation	Tolerance	Result
45°	45°	0	42-48	Pass
135°	135°	1	132-138	Pass
225°	225°	2	222-228	Pass
315°	315°	1	312-318	Pass
358°	0°	2	355-3	Pass

Inspection Room Temp	Actual Value	Deviation	Tolerance	Result
22.5°C	22.5°C	0.0	21.5-23.5	Pass

Atmospheric Pressure Inspection	Actual Value	Deviation	Tolerance	Result
1005	1005	0	1001-1019	Pass

Environment conditions:
 Air temperature: 22 °C
 Relative humidity: 55 %
 Static pressure: 102.2 kPa

Performed by: [Signature]
 Confirmed by Head of Engineering department

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INNOVATIVE INSTRUMENT CALIBRATION LAB
 INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
 7139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KAO,
 AMPHIB BANG PUEI SAMUT PRAKAN PROVINCE 10140 THAILAND
 TEL: 08940-2110-5900-1 FAX: 08940-2110-7140



Certificate of Calibration

Customer: UNITED ANALYST AND ENGINEERING CONSULTANT
 Name: CO.,LTD.
 Address: 181 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
 Certificate No.: 23-ACT-056
 Request No.: Req-2023-0788

Unit Under Calibration Details

Measurement Item: Acoustic Calibrator
 Manufacturer: LARSON DAVIS
 Model: CAL150
 Serial Number: 6695
 ID: UAE.FPM.140/2565
 Class: 2
 Range: 94, 114 dB / 1000 Hz
 Instrument Status: Used

Calibration Environment and Details

Temperature: (23 ± 2 °C)
 Humidity: (50 ± 20 %RH)
 Barometric Pressure: (1013 ± 10.0 hPa)
 Received Date: 17 April 2023
 Calibration Date: 20 April 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	EEL	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: [Signature]
 Mr. Noppadon [Signature]
 Service Calibration Engineer

Approved By: [Signature]
 Mr. Pacit [Signature]
 Calibration Engineer Supervisor
 Issue Date: 20 April 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Certificate No : 23-ACT-056
Request No : Roq-2023-0788

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	93.86	-0.14	-	-	0.13	0.40
114 dB / 1000 Hz	113.96	-0.04	-	-	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	1000.00	0.00	-	-	0.01	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	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	0.27		-	-	0.40	3.0
114 dB / 1000 Hz	0.33		-	-	0.40	3.0

Note :

- Acceptance limit was IEC6082:2017 Class 1
- The calibration results exclude the calibration pressure correction
- The calibration results exclude the microphone volume correction

End of Calibration

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Calibration Certificate

Certificate Number 2022003082

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udonnok 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:

PCB 375A04, S/N 335074
Larson Davis CAL291, S/N 0108
Larson Davis CAL200, S/N 9079
Larson Davis PRLxT2C, S/N 071570

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
IEC 60804:2000 Type 2
IEC 61252:2002
IEC 61260:2001 Class 2
IEC 61672:2013 Class 2

ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.11 (R2009) Class 2
ANSI S1.25 (R2007)
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, (770.01 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 µPa

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

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	2022-02-21	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 -

- End of Report -

Signature: *Jacob Cannon*

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Calibration Certificate

Certificate Number 2022002977

Customer:

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

Model Number	LxT2	Procedure Number	D0001.8378
Serial Number	0009559	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 PRLxT2C 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, 1770.01 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 2626-41 Temperature Probe	2021-02-04	2022-08-04	066767
SRS D8360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	067635

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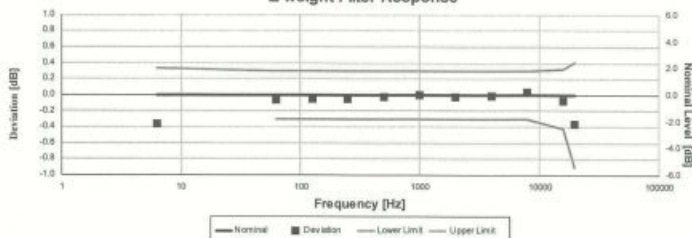
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Certificate Number 2022002977

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
63.1	-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	-0.03	-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	-0.06	-0.06	-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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Certificate Number 2022002977

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
50.00	-0.03	-0.70	0.70	0.16	Pass
51.00	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.05	-0.70	0.70	0.16	Pass
53.00	-0.05	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.05	-0.70	0.70	0.16	Pass
57.00	-0.05	-0.70	0.70	0.16	Pass
58.00	-0.05	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
60.00	-0.05	-0.70	0.70	0.16	Pass
61.00	-0.05	-0.70	0.70	0.16	Pass
62.00	-0.05	-0.70	0.70	0.16	Pass
63.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
65.00	-0.05	-0.70	0.70	0.16	Pass
66.00	-0.05	-0.70	0.70	0.16	Pass
67.00	-0.05	-0.70	0.70	0.16	Pass
68.00	-0.05	-0.70	0.70	0.16	Pass
69.00	-0.05	-0.70	0.70	0.16	Pass
70.00	-0.05	-0.70	0.70	0.16	Pass
71.00	-0.05	-0.70	0.70	0.16	Pass
72.00	-0.05	-0.70	0.70	0.16	Pass
73.00	-0.05	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
75.00	-0.05	-0.70	0.70	0.16	Pass
76.00	-0.05	-0.70	0.70	0.16	Pass
77.00	-0.05	-0.70	0.70	0.16	Pass
78.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
80.00	-0.05	-0.70	0.70	0.16	Pass
81.00	-0.05	-0.70	0.70	0.16	Pass
82.00	-0.05	-0.70	0.70	0.16	Pass
83.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
85.00	-0.05	-0.70	0.70	0.16	Pass
86.00	-0.05	-0.70	0.70	0.16	Pass
87.00	-0.05	-0.70	0.70	0.16	Pass
88.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.05	-0.70	0.70	0.16	Pass
90.00	-0.05	-0.70	0.70	0.16	Pass
91.00	-0.05	-0.70	0.70	0.16	Pass
92.00	-0.05	-0.70	0.70	0.16	Pass
93.00	-0.05	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
95.00	-0.05	-0.70	0.70	0.16	Pass
96.00	-0.05	-0.70	0.70	0.16	Pass
97.00	-0.05	-0.70	0.70	0.16	Pass
98.00	-0.05	-0.70	0.70	0.16	Pass
99.00	-0.05	-0.70	0.70	0.16	Pass
100.00	-0.05	-0.70	0.70	0.16	Pass
101.00	-0.05	-0.70	0.70	0.16	Pass
102.00	-0.05	-0.70	0.70	0.16	Pass
103.00	-0.05	-0.70	0.70	0.16	Pass
104.00	-0.05	-0.70	0.70	0.16	Pass
105.00	-0.05	-0.70	0.70	0.16	Pass
106.00	-0.05	-0.70	0.70	0.16	Pass
107.00	-0.05	-0.70	0.70	0.16	Pass
108.00	-0.05	-0.70	0.70	0.16	Pass
109.00	-0.05	-0.70	0.70	0.16	Pass
110.00	-0.05	-0.70	0.70	0.16	Pass
111.00	-0.05	-0.70	0.70	0.16	Pass
112.00	-0.05	-0.70	0.70	0.16	Pass
113.00	-0.05	-0.70	0.70	0.16	Pass
114.00	-0.05	-0.70	0.70	0.16	Pass
115.00	-0.05	-0.70	0.70	0.16	Pass
116.00	-0.05	-0.70	0.70	0.16	Pass
117.00	-0.05	-0.70	0.70	0.16	Pass
118.00	-0.05	-0.70	0.70	0.16	Pass
119.00	-0.05	-0.70	0.70	0.16	Pass
120.00	-0.05	-0.70	0.70	0.16	Pass
121.00	-0.05	-0.70	0.70	0.16	Pass
122.00	-0.05	-0.70	0.70	0.16	Pass
123.00	-0.05	-0.70	0.70	0.16	Pass
124.00	-0.05	-0.70	0.70	0.16	Pass
125.00	-0.05	-0.70	0.70	0.16	Pass
126.00	-0.05	-0.70	0.70	0.16	Pass
127.00	-0.05	-0.70	0.70	0.16	Pass
128.00	-0.05	-0.70	0.70	0.16	Pass
129.00	-0.05	-0.70	0.70	0.16	Pass
130.00	-0.05	-0.70	0.70	0.16	Pass
131.00	-0.05	-0.70	0.70	0.16	Pass
132.00	-0.05	-0.70	0.70	0.16	Pass
133.00	-0.05	-0.70	0.70	0.16	Pass
134.00	-0.05	-0.70	0.70	0.16	Pass
135.00	-0.05	-0.70	0.70	0.16	Pass
136.00	-0.05	-0.70	0.70	0.16	Pass
137.00	-0.05	-0.70	0.70	0.16	Pass
138.00	-0.05	-0.70	0.70	0.16	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
135.95	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	OVL	± 1.00	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
125.95	3	-0.18	± 1.00	0.15 ±	Pass
	5	-0.18	± 1.00	0.15 ±	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	OVL	± 1.00	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
125.95	3	-0.17	± 1.00	0.15 ±	Pass
	5	-0.15	± 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	93.96	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

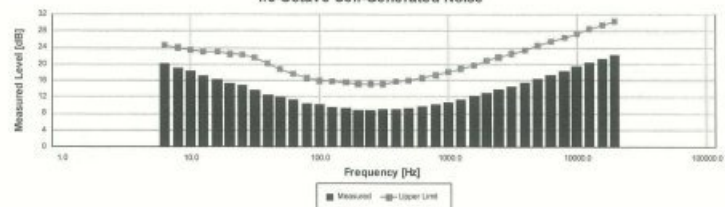
Measured using 1/3-Octave filters

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	-58.00	0.00 ±	Pass
THD+N	-63.08	-58.00	-58.00	0.00 ±	Pass

-- End of measurement results--

Certificate Number 2022002977

1/3-Octave Self-Generated Noise



The SLIM 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	11.48	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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Calibration Certificate

Certificate Number 2022003087

Customer:

United Analysis and Engineering Consultant Co Ltd

No. 81 Soi Udonsak 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:

PCB 375A04, S/N 335075

Larson Davis CAL291, S/N 0108

Larson Davis CAL200, S/N 9079

Larson Davis PRMLXT2C, S/N 071560

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

IEC 60804:2000 Type 2

IEC 61252:2002

IEC 61260:2001 Class 2

IEC 61672:2013 Class 2

ANSI S1.4-2014 Class 2

ANSI S1.4 (R2006) Type 2

ANSI S1.11 (R2009) Class 2

ANSI S1.25 (R2007)

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 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 Part 3.

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 performance 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-R 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	007183
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—

— End of Report—

Signature: Jacob Cannon

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Certificate Number 2022003087

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 3: 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—

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002970

Customer:

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

Model Number LxT2
Serial Number 0005591
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 PRLxT2C 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/µPa.

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

IEC 60851:2001 Type 2
IEC 60804:2000 Type 2
IEC 61252:2002
IEC 61672:2013 Class 2
IEC 61260:2001 Class 2

ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 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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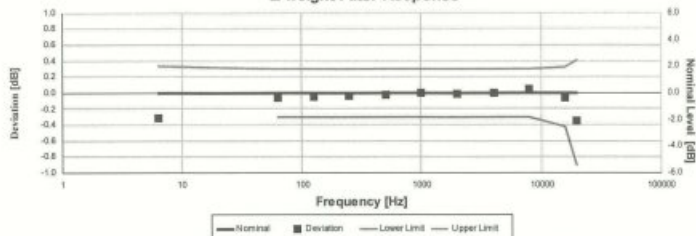
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Certificate Number 2022002970

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 60851:2001 5.1 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 --

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Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2625-II 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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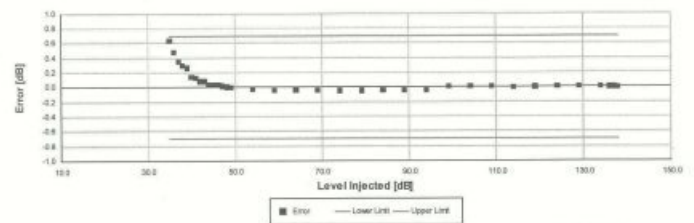
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Certificate Number 2022002970

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 6, ANSI S1.4 (R2006) 6.9, ANSI S1.4-2014 Part 1: 5.6, ANSI S1.43 (R2007) 5.2

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
50.00	-0.03	-0.70	0.70	0.16	Pass
51.00	-0.04	-0.70	0.70	0.16	Pass
52.00	-0.03	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.04	-0.70	0.70	0.16	Pass
57.00	-0.04	-0.70	0.70	0.16	Pass
58.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
60.00	-0.01	-0.70	0.70	0.15	Pass
61.00	0.02	-0.70	0.70	0.15	Pass
62.00	0.02	-0.70	0.70	0.15	Pass
63.00	0.01	-0.70	0.70	0.15	Pass
64.00	0.00	-0.70	0.70	0.15	Pass
65.00	0.00	-0.70	0.70	0.15	Pass
66.00	0.01	-0.70	0.70	0.15	Pass
67.00	0.01	-0.70	0.70	0.15	Pass
68.00	0.01	-0.70	0.70	0.15	Pass
69.00	0.01	-0.70	0.70	0.15	Pass
70.00	0.01	-0.70	0.70	0.15	Pass
71.00	0.01	-0.70	0.70	0.15	Pass
72.00	0.01	-0.70	0.70	0.15	Pass
73.00	0.01	-0.70	0.70	0.15	Pass
74.00	0.01	-0.70	0.70	0.15	Pass
75.00	0.01	-0.70	0.70	0.15	Pass
76.00	0.01	-0.70	0.70	0.15	Pass
77.00	0.01	-0.70	0.70	0.15	Pass
78.00	0.01	-0.70	0.70	0.15	Pass
79.00	0.01	-0.70	0.70	0.15	Pass
80.00	0.01	-0.70	0.70	0.15	Pass
81.00	0.01	-0.70	0.70	0.15	Pass
82.00	0.01	-0.70	0.70	0.15	Pass
83.00	0.01	-0.70	0.70	0.15	Pass
84.00	0.01	-0.70	0.70	0.15	Pass
85.00	0.01	-0.70	0.70	0.15	Pass
86.00	0.01	-0.70	0.70	0.15	Pass
87.00	0.01	-0.70	0.70	0.15	Pass
88.00	0.01	-0.70	0.70	0.15	Pass
89.00	0.01	-0.70	0.70	0.15	Pass
90.00	0.01	-0.70	0.70	0.15	Pass
91.00	0.01	-0.70	0.70	0.15	Pass
92.00	0.01	-0.70	0.70	0.15	Pass
93.00	0.01	-0.70	0.70	0.15	Pass
94.00	0.01	-0.70	0.70	0.15	Pass
95.00	0.01	-0.70	0.70	0.15	Pass
96.00	0.01	-0.70	0.70	0.15	Pass
97.00	0.01	-0.70	0.70	0.15	Pass
98.00	0.01	-0.70	0.70	0.15	Pass
99.00	0.01	-0.70	0.70	0.15	Pass
100.00	0.01	-0.70	0.70	0.15	Pass
101.00	0.01	-0.70	0.70	0.15	Pass
102.00	0.01	-0.70	0.70	0.15	Pass
103.00	0.01	-0.70	0.70	0.15	Pass
104.00	0.01	-0.70	0.70	0.15	Pass
105.00	0.01	-0.70	0.70	0.15	Pass
106.00	0.01	-0.70	0.70	0.15	Pass
107.00	0.01	-0.70	0.70	0.15	Pass
108.00	0.01	-0.70	0.70	0.15	Pass
109.00	0.01	-0.70	0.70	0.15	Pass
110.00	0.01	-0.70	0.70	0.15	Pass
111.00	0.01	-0.70	0.70	0.15	Pass
112.00	0.01	-0.70	0.70	0.15	Pass
113.00	0.01	-0.70	0.70	0.15	Pass
114.00	0.01	-0.70	0.70	0.15	Pass
115.00	0.01	-0.70	0.70	0.15	Pass
116.00	0.01	-0.70	0.70	0.15	Pass
117.00	0.01	-0.70	0.70	0.15	Pass
118.00	0.01	-0.70	0.70	0.15	Pass
119.00	0.01	-0.70	0.70	0.15	Pass
120.00	0.01	-0.70	0.70	0.15	Pass
121.00	0.01	-0.70	0.70	0.15	Pass
122.00	0.01	-0.70	0.70	0.15	Pass
123.00	0.01	-0.70	0.70	0.15	Pass
124.00	0.01	-0.70	0.70	0.15	Pass
125.00	0.01	-0.70	0.70	0.15	Pass
126.00	0.01	-0.70	0.70	0.15	Pass
127.00	0.01	-0.70	0.70	0.15	Pass
128.00	0.01	-0.70	0.70	0.15	Pass
129.00	0.01	-0.70	0.70	0.15	Pass
130.00	0.01	-0.70	0.70	0.15	Pass
131.00	0.01	-0.70	0.70	0.15	Pass
132.00	0.01	-0.70	0.70	0.15	Pass
133.00	0.01	-0.70	0.70	0.15	Pass
134.00	0.01	-0.70	0.70	0.15	Pass
135.00	0.01	-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 6051:2001 9.4.4 and ANSI S1.4-1983 (R2005) 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	136.65	0.15	Pass
		Positive Pulse	135.12	133.64	136.64	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 6051:2001 9.4.2 and ANSI S1.4-1983 (R2005) 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	-0.14	± 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 6051:2001 9.4.2 and ANSI S1.4-1983 (R2005) 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	-0.12	± 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	-58.00	0.01 ±	Pass
THD+N	-62.05	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results --

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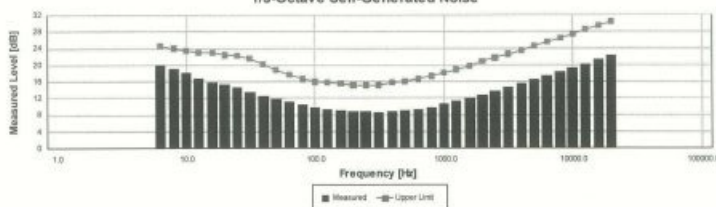
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1/3-Octave Self-Generated Noise



The SLM is set to low range.

Frequency [Hz]	Test Result [dB]	Upper Limit [dB]	Result
6.30	19.93	24.80	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	10.90	18.10	Pass
1,250.00	11.29	19.90	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 --

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022003094

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

Model Number	LxT2	Procedure Number	D0001.8384
Serial Number	0006692	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	11 Mar 2022
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 2 Class 2 Sound Level Meter Firmware Revision: 2.404	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:
Larson Davis CAL200, S/N 9079
Larson Davis PRMLxT2C, S/N 071561
PCB 375A04, S/N 335076
Larson Davis CAL291, S/N 0108

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 60851:2001 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 µPa

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

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

The sound level meter submitted for testing successfully completed the periodic tests of IEC 61672-3:2013 / ANSIASA 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 / ANSIASA 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 / ANSIASA 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 / ANSIASA S1.4-2014 Part 3 cover only a limited subset of the specifications in IEC 61672-1:2013 / ANSIASA 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	-46.33	0.14	Pass

— End of measurement results—

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Certificate Number 2022003094

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—

Signature: Jacob Cannon

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Calibration Certificate

Certificate Number 2022002971

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

Model Number	LxT2	Procedure Number	D0001.8378
Serial Number	0006692	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	23.91 °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 60851:2001 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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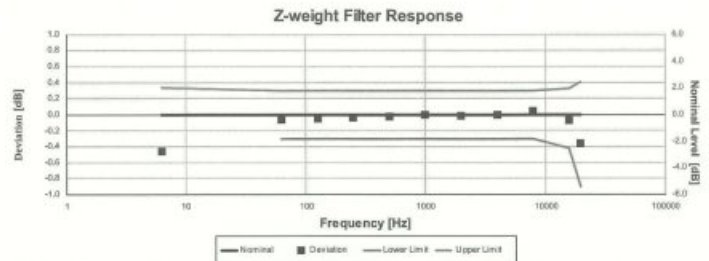
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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2636-H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2021-07-22	2022-07-22	007174

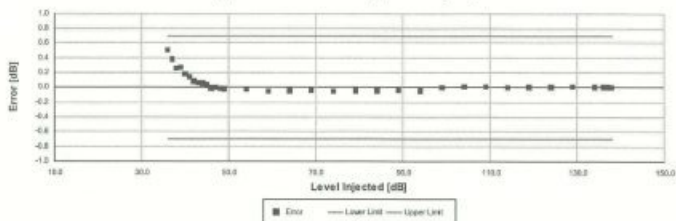


Electrical signal test of frequency weighting performed according to IEC 61672-3:2013 13 and ANSI S1.4-2014 Part 3, 13 for compliance to IEC 61672-1:2013 5.5, IEC 60651:2001 5.1 and 9.2.2, IEC 60804:2000 5, ANSI S1.4-1983 (R2006) 5.1 and 8.2.1, ANSI S1.4-2014 Part 1: 5.5

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--						

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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	0.26	-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
50.00	-0.03	-0.70	0.70	0.16	Pass
51.00	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.05	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.05	-0.70	0.70	0.16	Pass
57.00	-0.05	-0.70	0.70	0.16	Pass
58.00	-0.05	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
60.00	-0.04	-0.70	0.70	0.16	Pass
61.00	-0.05	-0.70	0.70	0.16	Pass
62.00	-0.05	-0.70	0.70	0.16	Pass
63.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
65.00	-0.05	-0.70	0.70	0.16	Pass
66.00	-0.05	-0.70	0.70	0.16	Pass
67.00	-0.05	-0.70	0.70	0.16	Pass
68.00	-0.05	-0.70	0.70	0.16	Pass
69.00	-0.05	-0.70	0.70	0.16	Pass
70.00	-0.05	-0.70	0.70	0.16	Pass
71.00	-0.05	-0.70	0.70	0.16	Pass
72.00	-0.05	-0.70	0.70	0.16	Pass
73.00	-0.05	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
75.00	-0.05	-0.70	0.70	0.16	Pass
76.00	-0.05	-0.70	0.70	0.16	Pass
77.00	-0.05	-0.70	0.70	0.16	Pass
78.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
80.00	-0.05	-0.70	0.70	0.16	Pass
81.00	-0.05	-0.70	0.70	0.16	Pass
82.00	-0.05	-0.70	0.70	0.16	Pass
83.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
85.00	-0.05	-0.70	0.70	0.16	Pass
86.00	-0.05	-0.70	0.70	0.16	Pass
87.00	-0.05	-0.70	0.70	0.16	Pass
88.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.05	-0.70	0.70	0.16	Pass
90.00	-0.05	-0.70	0.70	0.16	Pass
91.00	-0.05	-0.70	0.70	0.16	Pass
92.00	-0.05	-0.70	0.70	0.16	Pass
93.00	-0.05	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
95.00	-0.05	-0.70	0.70	0.16	Pass
96.00	-0.05	-0.70	0.70	0.16	Pass
97.00	-0.05	-0.70	0.70	0.16	Pass
98.00	-0.05	-0.70	0.70	0.16	Pass
99.00	-0.05	-0.70	0.70	0.16	Pass
100.00	-0.05	-0.70	0.70	0.16	Pass
101.00	-0.05	-0.70	0.70	0.16	Pass
102.00	-0.05	-0.70	0.70	0.16	Pass
103.00	-0.05	-0.70	0.70	0.16	Pass
104.00	-0.05	-0.70	0.70	0.16	Pass
105.00	-0.05	-0.70	0.70	0.16	Pass
106.00	-0.05	-0.70	0.70	0.16	Pass
107.00	-0.05	-0.70	0.70	0.16	Pass
108.00	-0.05	-0.70	0.70	0.16	Pass
109.00	-0.05	-0.70	0.70	0.16	Pass
110.00	-0.05	-0.70	0.70	0.16	Pass
111.00	-0.05	-0.70	0.70	0.16	Pass
112.00	-0.05	-0.70	0.70	0.16	Pass
113.00	-0.05	-0.70	0.70	0.16	Pass
114.00	-0.05	-0.70	0.70	0.16	Pass
115.00	-0.05	-0.70	0.70	0.16	Pass
116.00	-0.05	-0.70	0.70	0.16	Pass
117.00	-0.05	-0.70	0.70	0.16	Pass
118.00	-0.05	-0.70	0.70	0.16	Pass
119.00	-0.05	-0.70	0.70	0.16	Pass
120.00	-0.05	-0.70	0.70	0.16	Pass
121.00	-0.05	-0.70	0.70	0.16	Pass
122.00	-0.05	-0.70	0.70	0.16	Pass
123.00	-0.05	-0.70	0.70	0.16	Pass
124.00	-0.05	-0.70	0.70	0.16	Pass
125.00	-0.05	-0.70	0.70	0.16	Pass
126.00	-0.05	-0.70	0.70	0.16	Pass
127.00	-0.05	-0.70	0.70	0.16	Pass
128.00	-0.05	-0.70	0.70	0.16	Pass
129.00	-0.05	-0.70	0.70	0.16	Pass
130.00	-0.05	-0.70	0.70	0.16	Pass
131.00	-0.05	-0.70	0.70	0.16	Pass
132.00	-0.05	-0.70	0.70	0.16	Pass
133.00	-0.05	-0.70	0.70	0.16	Pass
134.00	-0.05	-0.70	0.70	0.16	Pass
135.00	-0.05	-0.70	0.70	0.16	Pass
136.00	-0.05	-0.70	0.70	0.16	Pass
137.00	-0.05	-0.70	0.70	0.16	Pass
138.00	-0.05	-0.70	0.70	0.16	Pass
139.00	-0.05	-0.70	0.70	0.16	Pass
140.00	-0.05	-0.70	0.70	0.16	Pass
141.00	-0.05	-0.70	0.70	0.16	Pass
142.00	-0.05	-0.70	0.70	0.16	Pass
143.00	-0.05	-0.70	0.70	0.16	Pass
144.00	-0.05	-0.70	0.70	0.16	Pass
145.00	-0.05	-0.70	0.70	0.16	Pass
146.00	-0.05	-0.70	0.70	0.16	Pass
147.00	-0.05	-0.70	0.70	0.16	Pass
148.00	-0.05	-0.70	0.70	0.16	Pass
149.00	-0.05	-0.70	0.70	0.16	Pass
150.00	-0.05	-0.70	0.70	0.16	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—

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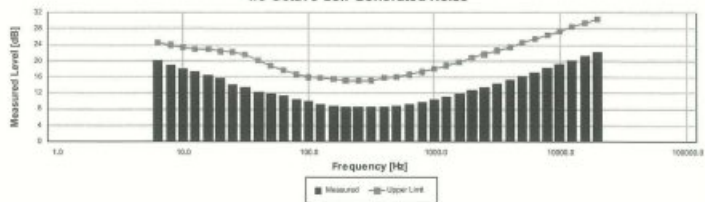
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1/3-Octave Self-Generated Noise



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	9.22	15.90	Pass
125.00	8.88	15.70	Pass
160.00	8.61	15.50	Pass
200.00	8.49	15.20	Pass
250.00	8.48	15.20	Pass
315.00	8.54	15.70	Pass
400.00	8.83	16.00	Pass
500.00	9.25	16.80	Pass
630.00	9.76	17.30	Pass
800.00	10.35	18.10	Pass
1,000.00	11.10	18.90	Pass
1,250.00	11.86	19.80	Pass
1,600.00	12.67	20.80	Pass
2,000.00	13.54	21.70	Pass
2,500.00	14.41	22.60	Pass
3,150.00	15.39	23.50	Pass
4,000.00	16.36	24.50	Pass
5,000.00	17.29	25.50	Pass
6,300.00	18.25	26.50	Pass
8,000.00	19.28	27.40	Pass
10,000.00	20.24	28.50	Pass
12,500.00	21.24	29.50	Pass
16,000.00	22.22	30.40	Pass

— End of measurement results—

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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 and 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

— End of Report—

Signature: Jacob Cannon

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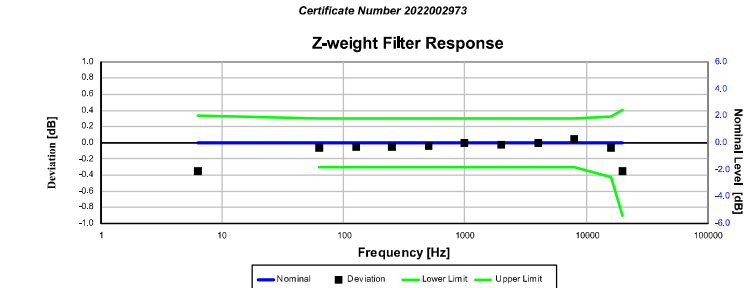


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Standards Used			
Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-4H Temperature Probe	2021-02-04	2022-08-04	006767
SRS DS360 Ultra Low Distortion Generator	2022-01-03	2023-01-03	007118



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--						

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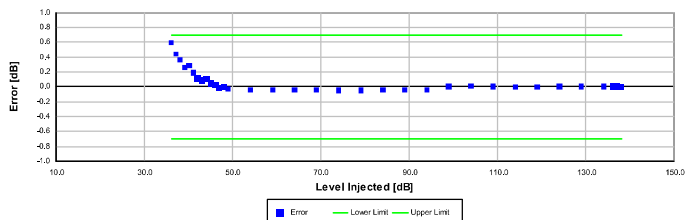


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A-weighted Broadband Log Linearity: 8,000.00 Hz

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	0,60	-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--					

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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	135,01	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--					

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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	27.08	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--

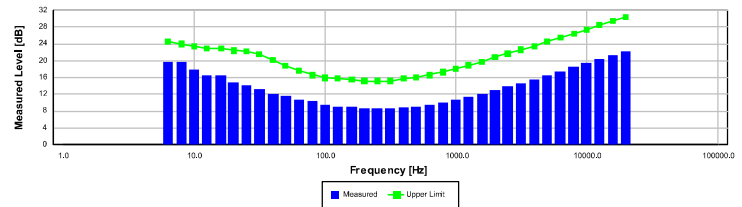
Total Harmonic Distortion

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	-58.00	0.01 ±	Pass
THD+N	-63.03	-58.00	-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--

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		TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN) CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES 5344 PHATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250 TEL: 0-2717-3000-34 FAX: 0-2719-4484	
Certificate of Calibration		Certificate No.: 23P1401 Page: 1 of 2	
Equipment:	U-Tube Manometer	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.	
Manufacturer:	Dwyer		
Model:	1221-36-W/M		
Serial No.:	-		
ID No.:	UAE.EFM.022/0580		
Condition As-Received:	Used Item		
Received Date:	26 April 2023		
Calibration Date:	09 May 2023		
Reference:	2304-0703WSC	Submitted by: United Analyst and Engineering Consultant Co., Ltd.	
Ambient Temperature:	(23 ± 2) °C	81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260	
Relative Humidity:	(50 ± 15) %		
Atmospheric Pressure:	1010 mbar		
Procedure used:	The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P04, using " DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014 " as a guidelines.		
Condition of this result of calibration			
1.Reference standards instruments :			
	Instrument	Model	Serial No. Certificate No. Due Date
1)	Pressure Calibrator	PC106P	1188 MP-0137-22 24 Aug 2023
2.This result of calibration was made on requested at the point specified by customer.			
3.Scale and conversion factor is 1 kPa = 4.0146293 mHzO			
4.This instrument was used clean air and oil as pressure media.			
5.This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.			
6.This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.			
7.The certificate is valid only to the item calibrated on date and place of calibration.			
8.This Certification is traceable to the International System of Unit maintained through:- National Institute of Metrology Thailand (NIMT)			
Calibrated by : Sure [Signature]		Approved Signatory : [Signature]	
Issue Date : 11 May 2023		[Signature] [Signature] [Signature]	

เอกสารไม่ควบคุม
0314241

LARSON DAVIS - A PCB PIEZOTRONICS DIV.

1681 West 820 North
Provo, UT 84601, United States
716-684-0001

Page 8 of 8



เอกสารไม่ควบคุม

2022-3-9T18:28:48



Cert.No.: 23P1401
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

Range: 0 inH₂O to 36 inH₂O
Scale Interval: 0.1 inH₂O (The Fifth Estimate)

UUC Indication				
Applied Pressure (inH ₂ O)	High-port side (inH ₂ O)	Low-port side (inH ₂ O)	ΔP (inH ₂ O)	Error (inH ₂ O)
0.00	0.00	0.00	0.00	0.00
2.00	1.00	-0.98	1.98	-0.02
4.00	2.00	-1.98	3.98	-0.02
6.00	3.00	-2.98	5.98	-0.02
8.00	4.00	-3.98	7.98	-0.02
10.00	5.00	-4.98	9.98	-0.02
12.00	6.00	-5.98	12.00	0.00
14.00	7.00	-7.00	14.00	0.00
16.00	8.00	-8.00	16.00	0.00
18.00	9.00	-9.00	18.00	0.00
20.00	10.00	-10.00	20.00	0.00
22.00	11.00	-11.00	22.00	0.00
24.00	12.00	-12.00	24.00	0.02
26.00	13.00	-13.00	26.00	0.02
28.00	14.00	-14.00	28.00	0.02
30.00	15.00	-15.00	30.00	0.04
32.00	16.00	-16.00	32.00	0.04
34.00	17.00	-17.00	34.00	0.02
36.00	18.00	-17.98	35.98	0.02

The uncertainty of measurement was ± 0.11 inH₂O

* UUC = Unit Under Calibration

* ΔP = High-port side - Low-port side

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

-000-

Attapol P.

เอกสารไม่ควบคุม
a 1160340



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL. 0-2717-3000-34 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23P1858
Page: 1 of 2

Equipment: Aneroid Barometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.124/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 02 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (23 ± 2) °C

Relative Humidity: (50 ± 15) %

Atmospheric Pressure: 1007 mbar

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong, Bangkok 10260

Procedure used: The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to in-house calibration procedure CP-P10, using "DKD-R 6-1 : Calibration of Pressure Gauges, Edition 03/2014" as a guidelines.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DP142	1422505048	MP-0094-23	03 May 2024
2. This instrument was installed in vertical orientation and center of the dial was used as the reference level.				
3. This result of calibration was made on requested at the point specified by customer.				
4. This result of calibration instrument was in absolute pressure.				
5. This instrument was used clean air as pressure media.				
6. The certificate is valid only to the item calibrated on date and place of calibration.				
7. This Calibration is traceable to the International System of Unit maintained through:-				
-National Institute of Metrology Thailand (NIMT)				

Calibrated by: Suksan
Issue Date: 08 June 2023

Approved Signatory:
[] Phaihee Pratsapaipal
[] Sura Suwannasri
[x] Attapol Panurach

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B 0316958



Cert.No.: 23P1858
Page: 2 of 2

Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range: 960 hPa to 1030 hPa
Scale Interval: 1 hPa (The Fifth Estimate)

Increasing Pressure

Applied Pressure (hPa)	959.93	970.47	981.93	991.32	1002.29	1011.64	1021.14	1032.30
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	0.07	-0.47	-1.93	-1.32	-2.29	-1.64	-1.14	-2.30

Decreasing Pressure

Applied Pressure (hPa)	1032.30	1021.44	1011.67	1002.36	992.35	981.94	970.49	959.94
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.30	-1.44	-1.67	-2.36	-2.35	-1.94	-0.49	0.06

The uncertainty of measurement was ± 0.30 hPa

* UUC = Unit Under Calibration

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

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Attapol P.

เอกสารไม่ควบคุม
a 1165506



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLIANG, SUANLIANG, BANGKOK 10250
TEL. 0-2717-3000-34 FAX. 0-2719-9484



Certificate of Calibration

Certificate No.: 23H1200
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer

Manufacturer: Barigo

Model: -

Serial No.: -

ID No.: UAE.ANV.130/2550

Condition As-Received: Used Item

Received Date: 26 May 2023

Calibration Date: 30 May 2023
to 06 June 2023

Reference: 2305-0919WSC

Ambient Temperature: (25 ± 3) °C

Relative Humidity: (50 ± 20) %

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.

Submitted by: United Analyst and Engineering Consultant Co., Ltd.

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phraekhanong, Bangkok 10260

Procedure used: Calibration were conducted using in-house calibration procedure CP-H02 according to comparison with standard chilled mirror sensor for humidity measurement function and comparison with standard temperature probe for temperature measurement function into humidity / temperature chamber.

Condition of this result of calibration

1. Reference standards instruments:

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Hygro-M2 Dew Point Monitor	5112	2360195	20703	02 Aug 2023
2) Handheld Thermometer With Sensor	1523	3240076	23105	15 Mar 2024
2. The certificate is valid only to the item calibrated on date and place of calibration.				
3. This Calibration is traceable to the International System of Unit maintained through:-				
-National Institute of Standards and Technology (NIST), The United States of America				
-Technology Promotion Association (Thailand-Japan), NSO-ONSC Accredited No. Calibration 0098				

Calibrated by: Somchai
Issue Date: 07 June 2023

Approved Signatory:
[x] Chakrit Waowwanjua
[] Ponthipha Tameyakul
[] Viporn Tantiyawutti

เอกสารไม่ควบคุม
B 0316274



Cert. No.: 23H1200
Page: 2 of 2

Result of Calibration:-
Function:

Before Adjustment
Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	48	7.9	1.8
25.0	60.0	63	3.0	1.7
25.0	80.0	76	-4.0	1.9

Result of Calibration:-
Function:

After Adjustment
Humidity Measurement

Reference Temperature (°C)	Standard Humidity (%R.H.)	UUC* Reading (%R.H.)	Error (%R.H.)	Uncertainty of Measurement (±%R.H.)
25.0	40.1	44	3.9	1.8
25.0	60.0	60	0.0	1.7
25.0	80.0	75	-5.0	1.9

Result of Calibration:-
Function:

Without Adjustment
Temperature Measurement

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
19.987	20.0	0.013	0.72
30.016	30.0	-0.016	0.72
39.944	39.5	-0.444	0.72

UUC* : Unit Under Calibration

The reported uncertainty of measurement was based on standard uncertainty multiplied by coverage factor k = 2.00, providing confidence level approximately 95%.

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Amf

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United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Jan 24, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778106

Standard Gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

Diluter Detail

Manufacturer :	Thermo Scientific
Model :	1461
Serial Number :	1180540071

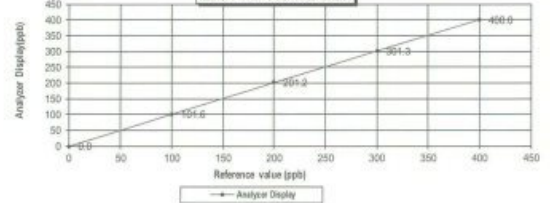
Multi-point gas test data

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	1.60	1.57	1.57
Level 3	40.00%	200.0	2.01	1.00	0.60
Level 4	60.00%	300.0	3.01	0.43	0.43
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit ± 5%

Average Difference (%) 0.52

Multi-Point Gas Test Chart



Calculate by

24 Jan 2023

Approve by

24 Jan 2023

Page 1 of 1

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United Analyst and Engineering Consultant Co., Ltd.
3 Soi Udomsak 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Tel. 0 2763 2828 Fax 0 2763 2800 www.uaeconsultant.com E-mail: uae@uaeconsultant.com

MULTI-POINT GAS TEST REPORT

Test Date : Feb 22, 2023

Equipment : Gas Analyzer (NO₂) Model : 421
Manufacturer : Thermo Scientific Serial Number : 1201778107

Standard Gas Concentration

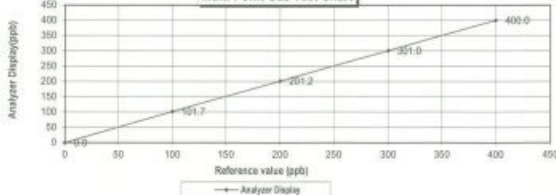
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	1461
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 21, 2024			

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	1.70	1.67	1.67
Level 3	40.00%	200.0	2.01	1.00	0.60
Level 4	60.00%	300.0	3.01	0.33	0.33
Level 5	80.00%	400.0	0.00	0.00	0.00

Remark : Measuring Range 500.0 ppb
Acceptable Limit ± 5%

Multi-Point Gas Test Chart



Calculate by

22 Feb 2023

Approve by

22 Feb 2023

Page 1 of 1

เอกสารไม่ควบคุม



CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A0103 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 Gases Calibration Standards (May 2012) document EPA 600/R-12/031, 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 module. All concentrations are on a mole/mole basis unless otherwise noted.
Do Not Use This Cylinder below 100 ppb, i.e. 8.7 megapascals.

Component	Requested Concentration	Actual Concentration	Protocol Method	Total Relative Uncertainty	Assay Dates
NOX	45.00 PPM	45.96 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	+/- 1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	+/- 1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	+/- 0.7% NIST Traceable	09/14/2021
NITROGEN	Balance				

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20081120	CC700086	40.82 PPM NITRIC OXIDE/NITROGEN	+/- 1.5%	Feb 02, 2025
PRM	12380	D865025	9.91 PPM NITROGEN DIOXIDE/AIR	+/- 2.5%	Feb 20, 2020
GMIS	401423830102	CC505581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	+/- 2.1	Jun 17, 2022
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	+/- 0.8%	Nov 15, 2023
NTRM	14080119	CC434277	980.9 PPM CARBON MONOXIDE/NITROGEN	+/- 0.6%	

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.

Approved for Release



CERT 3082.01

เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 9, 2023

Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo SCIENTIFIC Serial Number : CM22387065

Standard Gas Concentration

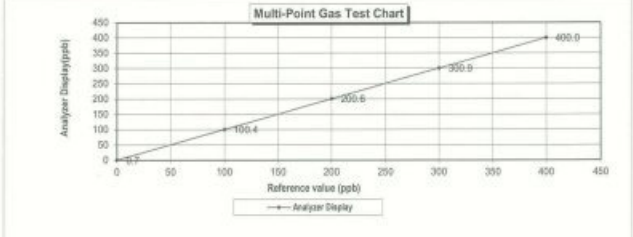
Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo SCIENTIFIC
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Methane (CH ₄)	-	PPM	Serial Number :	1180540071
Carbon Monoxide (CO)	984.8			
Cylinder No. :	EB0143262			
Expiration Date :	Jun 24, 2024			

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	0.70	0.70	0.70
Level 2 20.00%	100.0	0.40	0.40	0.40
Level 3 40.00%	200.6	0.60	0.30	0.30
Level 4 60.00%	300.9	0.90	0.30	0.30
Level 5 80.00%	400.0	0.00	0.00	0.00
Remark : Measuring Range	500.0 ppb	Average Difference (%)	0.34	
Acceptable Limit ± 5%				



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91, 1, 16
[Signature]
10, Jan, 2023

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MULTI-POINT GAS TEST REPORT

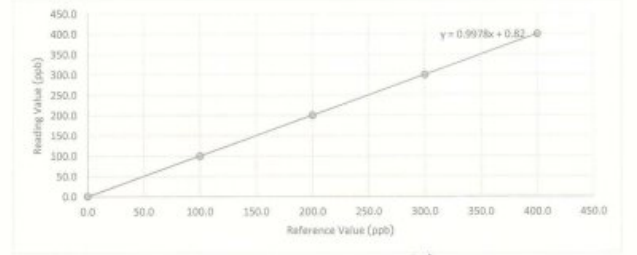
Equipment : Gas Analyzer (SO₂) Model : 43i
Manufacturer : Thermo Scientific Serial Number : CM22387066

Std. gas Concentration

Sulphur Dioxide (SO ₂)	44.68	PPM	Manufacturer :	Thermo Scientific
Nitric Oxide (NO)	45.94	PPM	Model :	146i
Carbon Monoxide (CO)	984.8		Serial Number :	1180540071
Cylinder No.	EB01432		Expiration Date	June 21, 2024

SO2 Multi-Point Calibration

Point	%	Ref. Value (ppb)	Read. SO2 (ppb)	Difference Error	Percent Error	% Error	Res. Time (min.)
Level 1	Zero	0.0	1.0	1.00	1.00	1.00	5
Level 2	20	100.0	100.2	0.20	0.20	0.20	5
Level 3	40	200.0	201.7	1.70	0.85	0.85	5
Level 4	60	300.0	301.3	1.30	0.43	0.43	5
Level 5	80	400.0	400.8	0.80	0.00	0.00	5
R	Slope	Intercept	Average		0.50		
	1.000	0.999	1.020	Criteria	5.00	10	



Calibrate by : [Signature]
Calibration Date : 7/9/16
Approve by : [Signature]
Approved Date : 8 Aug 2023

เอกสารไม่ควบคุม

CERTIFICATE OF ANALYSIS
Grade of Product: EPA Protocol

Part Number: E04N199E15A01D3 Reference Number: 122-402135167-1
Cylinder Number: E04N13262 Cylinder Volume: 144.4 CF
Laboratory: 124 - Durham (SAP) - NC Cylinder Pressure: 2015 PSIG
PGVP Number: B22021 Valve Outlet: 680
Gas Code: CO,NO,NOX,SO2,BALN Certification Date: Jun 21, 2021
Expiration Date: Jun 21, 2024

Certification performed in accordance with EPA Testability Protocol for Analyze and Certification of Gases Calibration Standards (May 2012) document EPA 800R-12/931, 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. 6.7 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	09/14/2021, 09/21/2021
NITRIC OXIDE	45.00 PPM	45.94 PPM	G1	±1.4% NIST Traceable	09/14/2021, 09/21/2021
SULFUR DIOXIDE	45.00 PPM	44.98 PPM	G1	±1.0% NIST Traceable	09/14/2021, 09/21/2021
CARBON MONOXIDE	1000 PPM	984.8 PPM	G1	±0.7% NIST Traceable	09/14/2021
NITROGEN	Balance				

CALIBRATION STANDARDS

Type	Lot ID	Cylinder No	Concentration	Uncertainty	Expiration Date
NTRM	20001120	CC706068	40.82 PPM NITRIC OXIDE/NITROGEN	±1.5%	Feb 02, 2026
NTRM	12386	D865025	9.91 PPM NITROGEN DIOXIDE/AIR	±2.5%	Feb 03, 2020
GMIS	40142830102	CC605581	4.348 PPM NITROGEN DIOXIDE/NITROGEN	±1.1%	Feb 18, 2023
NTRM	16011043	CC473277	46.02 PPM SULFUR DIOXIDE/NITROGEN	±0.8%	Jun 17, 2022
NTRM	14060119	CC434277	980.8 PPM CARBON MONOXIDE/NITROGEN	±0.6%	Nov 15, 2025

The GDS, PRM or RDM noted above is only in reference to the GMS 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.

Approved for Release

เอกสารไม่ควบคุม

Certificate of Calibration
WL-21 Wireless Anemometer

Scarlet Tech Ltd. hereby certifies that the WL-21 wireless anemometer listed below was thoroughly calibrated, tested and inspected following the standard calibration procedure (SI-WL-21) and is within manufacturer's specification at the time when the calibration is done.

Client: Envir Service Co., Ltd.
Serial No.: 2205070114
Calibration Date: 2022/9/14
Calibration Expiry Date: 2023/9/13

The Result of Calibration

Velocity					
Measured Value (m/s)	Actual Value (m/s)	Deviation	Tolerance	Result	
1.0	1.0	0.0	0.9-1.1	Pass	
1.5	2.0	0.5	1.8-2.2	Pass	
5.1	5.0	0.1	4.7-5.3	Pass	
7.0	7.0	0.0	6.8-7.0	Pass	
10.1	10.0	0.1	9.5-10.5	Pass	
19.6	20.0	0.4	19.0-20.5	Pass	

Wind Direction					
Measured Value	Actual Value	Deviation	Tolerance	Result	
45°	45°	0	42-48	Pass	
136°	135°	1	132-138	Pass	
227°	225°	2	222-228	Pass	
316°	315°	1	312-318	Pass	
358°	0°	2	357-3	Pass	

Inspection					
Inspection	Actual Value	Deviation	Tolerance	Result	
Room Temp	22.5°C	22.5°C	0.0	21.5-23.5	Pass

Atmospheric Pressure					
Inspection	Actual Value	Deviation	Tolerance	Result	
Pressure	1005	1005	0	1001-1019	Pass

Environment conditions :
Air temperature: 22 °C
Relative humidity: 55 %
Static pressure: 102.2 kPa

Performed by : [Signature]
Certified by Head of Engineering department



This certificate may not be published or reproduced, except in full, without obtaining permission in writing from Scarlet Tech Ltd.
4F-3, No. 347, 2nd Sec., Heping E. Rd., Daan Dist. Taipei City 106, Taiwan

เอกสารไม่ควบคุม

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-056
Request No : Req-2023-0788

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : LARSON DAVIS
Model : CAL150
Serial Number : 6695
ID : UAE.EFM.140/2565
Class : 2
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details

Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 17 April 2023
Calibration Date : 20 April 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	EEL	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 : 
Mr. Noppadon 
Service Calibration Engineer
Approved By : 
Mr. Pacit 
Calibration Engineer Supervisor
Issue Date : 20 April 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Sound pressure level		Calibration Results : Without Adjustment			
Calibration Range (dB)	Without Adjustment (dB)	Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 2 (± dB)
		Measured	Error		
94 dB / 1000 Hz	93.86	-0.14	-	0.13	0.40
114 dB / 1000 Hz	113.96	-0.04	-	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	1000.00	0.00	-	-	0.01	1.7
114 dB / 1000 Hz	1000.00	0.00	-	-	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	0.27	-	0.40	3.0
114 dB / 1000 Hz	0.33	-	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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

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Calibration Certificate

Certificate Number 2022003082

Customer:
United Analyst and Engineering Consultant Co.Ltd
No. 81 Soi Udomsuk 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

Data reported in dB re 20 µPa.

Evaluation Method **Tested with:**
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
IEC 60804:2000 Type 2
IEC 61252:2002
IEC 61260:2001 Class 2
IEC 61672:2013 Class 2

ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.11 (R2009) Class 2
ANSI S1.26 (R2007)
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

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

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—

Signature: *Jacob Cannon*



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Calibration Certificate

Certificate Number 2022002977

Customer:

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

Model Number LxT2

Serial Number 0005659

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 23.97 °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
IEC 60804:2000 Type 2
IEC 61252:2002
IEC 61672:2013 Class 2
IEC 61260:2001 Class 2

ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 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 **2** 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

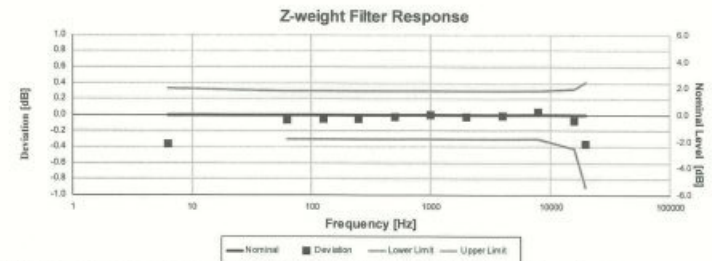


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Certificate Number 2022002977

Certificate Number 2022002977

Description	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-H Temperature Probe	2021-03-04	2022-08-04	066767
SRS DS360 Ultra Low Distortion Generator	2021-04-13	2022-04-13	007635



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	-0.03	-0.30	0.30	0.15	Pass
1,000.00	0.00	0.00	-0.30	0.30	0.15	Pass
1,995.26	-0.03	-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—

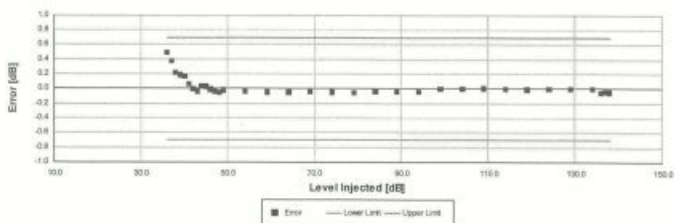


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เอกสารไม่ควบคุม

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	OVL	± 1.00	0.15 ±	Pass
	5	OVL	± 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	OVL	± 1.00	0.15 ±	Pass
	5	OVL	± 1.00	0.15 ±	Pass
125.95	3	-0.17	± 1.00	0.15 ±	Pass
	5	-0.15	± 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	-0.18	± 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	40.08	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

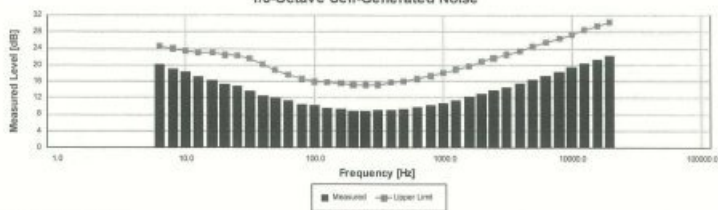
Measured using 1/3-Octave filters

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	-58.00	0.00 ±	Pass
THD+N	-63.08	-58.00	-58.00	0.00 ±	Pass

-- End of measurement results--

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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	11.48	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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D0001.8407 Rev F

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Calibration Certificate

Certificate Number 2022003087

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Sol Udonak 41, Sukhumvit Road,
Bangkok, Phra Khanong,
Bangkok, 10260, Thailand

Model Number	LxT2	Procedure Number	D0001.8384
Serial Number	0006691	Technician	Jacob Cannon
Test Results	Pass	Calibration Date	11 Mar 2022
Initial Condition	As Manufactured	Calibration Due	
Description	SoundTrack LxT Class 2 Class 2 Sound Level Meter Firmware Revision: 2.404	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 PRMLX2C, S/N 071580	

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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D0001.8407 Rev F

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Signature: Jacob Cannon

- End of Report -

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 Part 3.

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 performance 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-R 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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D0001.8407 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	0.17	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—

Signature: Jacob Cannon

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1681 West 820 North
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716-684-0001



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D0001.8407 Rev F

Calibration Certificate

Certificate Number 2022002970

Customer:

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

Model Number LxT2
Serial Number 0005891
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 60851:2001 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.

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

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

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

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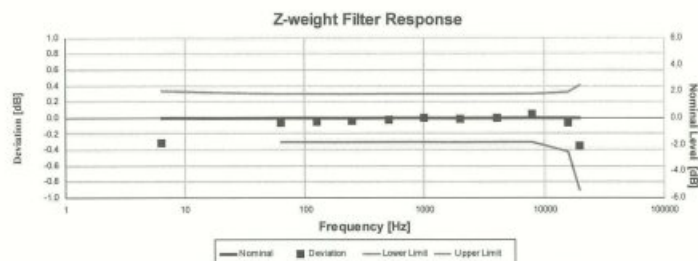
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เอกสารไม่ควบคุม

Certificate Number 2022002970

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

Certificate Number 2022002970



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 60851:2001 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—

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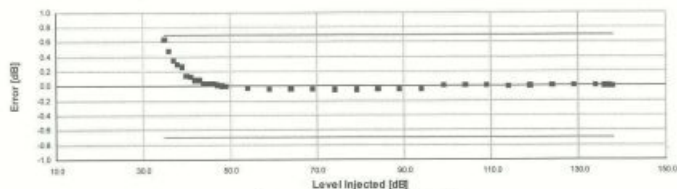


D0001.8407 Rev F

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เอกสารไม่ควบคุม

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 S1.4.3 (R2007) 6.2

Level [dB]	Error [dB]	Lower limit [dB]	Upper limit [dB]	Expanded Uncertainty [dB]	Result
35.00	0.54	-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--



Peak Rise Time

Peak rise time performed according to IEC 60591:2001 9.4.4 and ANSI S1.4:1983 (R2006) 8.4.4

Test results are performed according to the above test plan							
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	136.65	0.15	Pass
		Positive Pulse	135.12	133.64	136.64	0.15	Pass
	30	Negative Pulse	134.20	133.65	136.65	0.15	Pass
		Positive Pulse	134.20	133.64	136.64	0.15	Pass
Evaluation 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 60591:2001 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	OVLID	± 1.00	0.15 ±	Pass
	5	OVLID	± 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 60591:2001 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	OVLID	± 1.00	0.15 ±	Pass
	5	OVLID	± 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

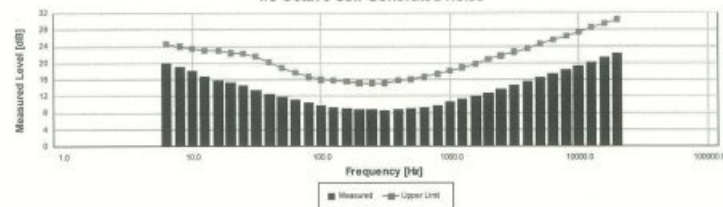
Measurement	Test Result [dB]	Lower Limit [dB]	Upper Limit [dB]	Expanded Uncertainty [dB]	Result
10 Hz Signal	135.67	134.15	135.75	0.15	Pass
THD	-65.74	-58.00	-58.00	0.01 ±	Pass
THD+N	-62.05	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results--



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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	19.06	24.00	Pass
10.00	18.09	23.50	Pass
12.50	18.82	23.00	Pass
16.00	16.82	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	10.40	18.10	Pass
1,250.00	11.28	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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Calibration Certificate

Certificate Number 2022003094

Customer:

United Analyst and Engineering Consultant Co Ltd
No. 81 Soi Udomsak 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
IEC 60804:2000 Type 2
IEC 61252:2002
IEC 61260:2001 Class 2
IEC 61672:2013 Class 2
ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.11 (R2009) Class 2
ANSI S1.25 (R2007)
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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Provo, UT 84601, United States
716-684-0001



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- End of Report -

Signatory: Jacob Cannon

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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: 154 dB re 20 µPa

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

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	2022-06-04	006767
Larson Davis CAL200 Acoustic Calibrator	2021-07-21	2022-07-21	007027
Larson Davis Model 831	2022-02-21	2022-02-21	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	-49.51	-52.44	-46.33	0.14	Pass

- 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 Udomsak 41, Sukhumvit Road,
Bangkok, Ploa Khanseng,
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 PPM LxT2C 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
IEC 60804:2000 Type 2
IEC 61252:2002
IEC 61672:2013 Class 2
IEC 61260:2001 Class 2

ANSI S1.4-2014 Class 2
ANSI S1.4 (R2006) Type 2
ANSI S1.25 (R2007)
ANSI S1.43 (R2007) Type 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, 2019-06-10

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

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A PCB DIVISION

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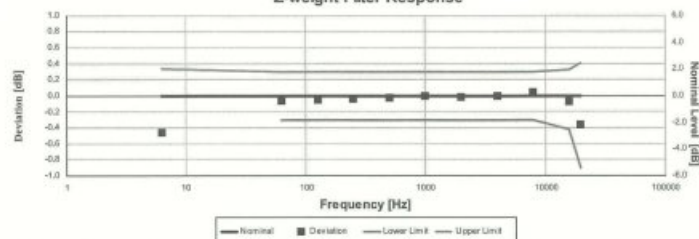
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Certificate Number 2022002971

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 5.1 and 8.2.2, 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 -

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Description	Standards Used	Cal Date	Cal Due	Cal Standard
Hart Scientific 2626-E 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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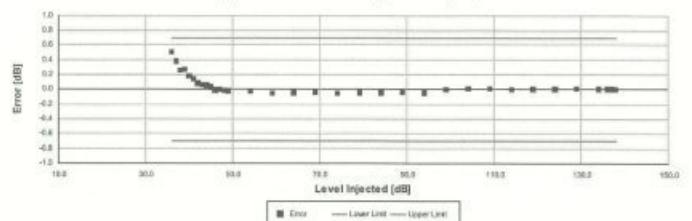
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D0001.8407 Rev F

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Certificate Number 2022002971

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 6.6, 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
50.00	-0.03	-0.70	0.70	0.16	Pass
51.00	-0.05	-0.70	0.70	0.16	Pass
52.00	-0.05	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.05	-0.70	0.70	0.16	Pass
57.00	-0.05	-0.70	0.70	0.16	Pass
58.00	-0.05	-0.70	0.70	0.16	Pass
59.00	-0.05	-0.70	0.70	0.16	Pass
60.00	-0.05	-0.70	0.70	0.16	Pass
61.00	-0.05	-0.70	0.70	0.16	Pass
62.00	-0.05	-0.70	0.70	0.16	Pass
63.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
65.00	-0.05	-0.70	0.70	0.16	Pass
66.00	-0.05	-0.70	0.70	0.16	Pass
67.00	-0.05	-0.70	0.70	0.16	Pass
68.00	-0.05	-0.70	0.70	0.16	Pass
69.00	-0.05	-0.70	0.70	0.16	Pass
70.00	-0.05	-0.70	0.70	0.16	Pass
71.00	-0.05	-0.70	0.70	0.16	Pass
72.00	-0.05	-0.70	0.70	0.16	Pass
73.00	-0.05	-0.70	0.70	0.16	Pass
74.00	-0.05	-0.70	0.70	0.16	Pass
75.00	-0.05	-0.70	0.70	0.16	Pass
76.00	-0.05	-0.70	0.70	0.16	Pass
77.00	-0.05	-0.70	0.70	0.16	Pass
78.00	-0.05	-0.70	0.70	0.16	Pass
79.00	-0.05	-0.70	0.70	0.16	Pass
80.00	-0.05	-0.70	0.70	0.16	Pass
81.00	-0.05	-0.70	0.70	0.16	Pass
82.00	-0.05	-0.70	0.70	0.16	Pass
83.00	-0.05	-0.70	0.70	0.16	Pass
84.00	-0.05	-0.70	0.70	0.16	Pass
85.00	-0.05	-0.70	0.70	0.16	Pass
86.00	-0.05	-0.70	0.70	0.16	Pass
87.00	-0.05	-0.70	0.70	0.16	Pass
88.00	-0.05	-0.70	0.70	0.16	Pass
89.00	-0.05	-0.70	0.70	0.16	Pass
90.00	-0.05	-0.70	0.70	0.16	Pass
91.00	-0.05	-0.70	0.70	0.16	Pass
92.00	-0.05	-0.70	0.70	0.16	Pass
93.00	-0.05	-0.70	0.70	0.16	Pass
94.00	-0.05	-0.70	0.70	0.16	Pass
95.00	-0.05	-0.70	0.70	0.16	Pass
96.00	-0.05	-0.70	0.70	0.16	Pass
97.00	-0.05	-0.70	0.70	0.16	Pass
98.00	-0.05	-0.70	0.70	0.16	Pass
99.00	-0.05	-0.70	0.70	0.16	Pass
100.00	-0.05	-0.70	0.70	0.16	Pass
101.00	-0.05	-0.70	0.70	0.16	Pass
102.00	-0.05	-0.70	0.70	0.16	Pass
103.00	-0.05	-0.70	0.70	0.16	Pass
104.00	-0.05	-0.70	0.70	0.16	Pass
105.00	-0.05	-0.70	0.70	0.16	Pass
106.00	-0.05	-0.70	0.70	0.16	Pass
107.00	-0.05	-0.70	0.70	0.16	Pass
108.00	-0.05	-0.70	0.70	0.16	Pass
109.00	-0.05	-0.70	0.70	0.16	Pass
110.00	-0.05	-0.70	0.70	0.16	Pass
111.00	-0.05	-0.70	0.70	0.16	Pass
112.00	-0.05	-0.70	0.70	0.16	Pass
113.00	-0.05	-0.70	0.70	0.16	Pass
114.00	-0.05	-0.70	0.70	0.16	Pass
115.00	-0.05	-0.70	0.70	0.16	Pass
116.00	-0.05	-0.70	0.70	0.16	Pass
117.00	-0.05	-0.70	0.70	0.16	Pass
118.00	-0.05	-0.70	0.70	0.16	Pass
119.00	-0.05	-0.70	0.70	0.16	Pass
120.00	-0.05	-0.70	0.70	0.16	Pass
121.00	-0.05	-0.70	0.70	0.16	Pass
122.00	-0.05	-0.70	0.70	0.16	Pass
123.00	-0.05	-0.70	0.70	0.16	Pass
124.00	-0.05	-0.70	0.70	0.16	Pass
125.00	-0.05	-0.70	0.70	0.16	Pass
126.00	-0.05	-0.70	0.70	0.16	Pass
127.00	-0.05	-0.70	0.70	0.16	Pass
128.00	-0.05	-0.70	0.70	0.16	Pass
129.00	-0.05	-0.70	0.70	0.16	Pass
130.00	-0.05	-0.70	0.70	0.16	Pass
131.00	-0.05	-0.70	0.70	0.16	Pass
132.00	-0.05	-0.70	0.70	0.16	Pass
133.00	-0.05	-0.70	0.70	0.16	Pass
134.00	-0.05	-0.70	0.70	0.16	Pass
135.00	-0.05	-0.70	0.70	0.16	Pass
136.00	-0.05	-0.70	0.70	0.16	Pass
137.00	-0.05	-0.70	0.70	0.16	Pass
138.00	-0.05	-0.70	0.70	0.16	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) 9.4.4

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
		Positive Pulse	135.12	133.64	135.84	0.15
	30	Negative Pulse	133.78	133.55	135.55	0.15
		Positive Pulse	133.90	133.64	135.64	0.15
-- 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) 9.4.2

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) 9.4.2

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	-58.00	0.01 ±	Pass
THD+N	-62.99	-58.00	-58.00	0.01 ±	Pass

-- End of measurement results --

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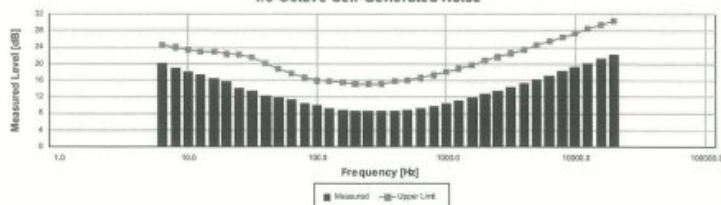
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1/3-Octave Self-Generated Noise



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	22.50	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	17.50	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	16.80	Pass
800.00	9.76	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 --

Signature: Jacob Cannon

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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.

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

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

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

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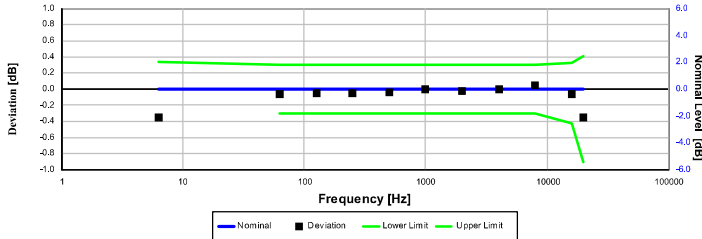


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Certificate Number 2022002973

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—

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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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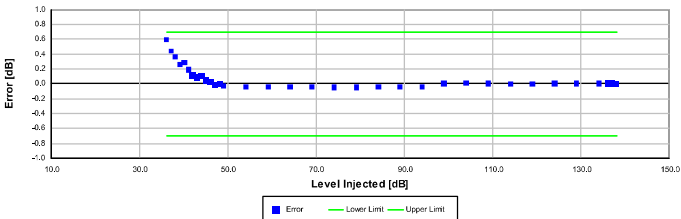


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Certificate Number 2022002973

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
50.00	-0.04	-0.70	0.70	0.16	Pass
51.00	-0.04	-0.70	0.70	0.16	Pass
52.00	-0.04	-0.70	0.70	0.16	Pass
53.00	-0.04	-0.70	0.70	0.16	Pass
54.00	-0.05	-0.70	0.70	0.16	Pass
55.00	-0.05	-0.70	0.70	0.16	Pass
56.00	-0.04	-0.70	0.70	0.16	Pass
57.00	-0.04	-0.70	0.70	0.16	Pass
58.00	-0.04	-0.70	0.70	0.16	Pass
59.00	-0.04	-0.70	0.70	0.16	Pass
60.00	-0.04	-0.70	0.70	0.16	Pass
61.00	-0.04	-0.70	0.70	0.16	Pass
62.00	-0.05	-0.70	0.70	0.16	Pass
63.00	-0.05	-0.70	0.70	0.16	Pass
64.00	-0.05	-0.70	0.70	0.16	Pass
65.00	-0.05	-0.70	0.70	0.16	Pass
66.00	-0.05	-0.70	0.70	0.16	Pass
67.00	-0.05	-0.70	0.70	0.16	Pass
68.00	-0.04	-0.70	0.70	0.16	Pass
69.00	-0.04	-0.70	0.70	0.16	Pass
70.00	-0.04	-0.70	0.70	0.16	Pass
71.00	-0.04	-0.70	0.70	0.16	Pass
72.00	-0.04	-0.70	0.70	0.16	Pass
73.00	-0.04	-0.70	0.70	0.16	Pass
74.00	-0.04	-0.70	0.70	0.16	Pass
75.00	-0.05	-0.70	0.70	0.16	Pass
76.00	-0.04	-0.70	0.70	0.16	Pass
77.00	-0.04	-0.70	0.70	0.16	Pass
78.00	-0.04	-0.70	0.70	0.16	Pass
79.00	-0.04	-0.70	0.70	0.16	Pass
80.00	-0.04	-0.70	0.70	0.16	Pass
81.00	-0.04	-0.70	0.70	0.16	Pass
82.00	-0.04	-0.70	0.70	0.16	Pass
83.00	-0.04	-0.70	0.70	0.16	Pass
84.00	-0.04	-0.70	0.70	0.16	Pass
85.00	-0.04	-0.70	0.70	0.16	Pass
86.00	-0.04	-0.70	0.70	0.16	Pass
87.00	-0.04	-0.70	0.70	0.16	Pass
88.00	-0.04	-0.70	0.70	0.16	Pass
89.00	-0.04	-0.70	0.70	0.16	Pass
90.00	-0.04	-0.70	0.70	0.16	Pass
91.00	-0.04	-0.70	0.70	0.16	Pass
92.00	-0.04	-0.70	0.70	0.16	Pass
93.00	-0.04	-0.70	0.70	0.16	Pass
94.00	-0.04	-0.70	0.70	0.16	Pass
95.00	-0.04	-0.70	0.70	0.16	Pass
96.00	-0.04	-0.70	0.70	0.16	Pass
97.00	-0.04	-0.70	0.70	0.16	Pass
98.00	-0.04	-0.70	0.70	0.16	Pass
99.00	-0.04	-0.70	0.70	0.16	Pass
100.00	-0.04	-0.70	0.70	0.16	Pass
101.00	-0.04	-0.70	0.70	0.16	Pass
102.00	-0.04	-0.70	0.70	0.16	Pass
103.00	-0.04	-0.70	0.70	0.16	Pass
104.00	-0.04	-0.70	0.70	0.16	Pass
105.00	-0.04	-0.70	0.70	0.16	Pass
106.00	-0.04	-0.70	0.70	0.16	Pass
107.00	-0.04	-0.70	0.70	0.16	Pass
108.00	-0.04	-0.70	0.70	0.16	Pass
109.00	-0.04	-0.70	0.70	0.16	Pass
110.00	-0.04	-0.70	0.70	0.16	Pass
111.00	-0.04	-0.70	0.70	0.16	Pass
112.00	-0.04	-0.70	0.70	0.16	Pass
113.00	-0.04	-0.70	0.70	0.16	Pass
114.00	-0.04	-0.70	0.70	0.16	Pass
115.00	-0.04	-0.70	0.70	0.16	Pass
116.00	-0.04	-0.70	0.70	0.16	Pass
117.00	-0.04	-0.70	0.70	0.16	Pass
118.00	-0.04	-0.70	0.70	0.16	Pass
119.00	-0.04	-0.70	0.70	0.16	Pass
120.00	-0.04	-0.70	0.70	0.16	Pass
121.00	-0.04	-0.70	0.70	0.16	Pass
122.00	-0.04	-0.70	0.70	0.16	Pass
123.00	-0.04	-0.70	0.70	0.16	Pass
124.00	-0.04	-0.70	0.70	0.16	Pass
125.00	-0.04	-0.70	0.70	0.16	Pass
126.00	-0.04	-0.70	0.70	0.16	Pass
127.00	-0.04	-0.70	0.70	0.16	Pass
128.00	-0.04	-0.70	0.70	0.16	Pass
129.00	-0.04	-0.70	0.70	0.16	Pass
130.00	-0.04	-0.70	0.70	0.16	Pass
131.00	-0.04	-0.70	0.70	0.16	Pass
132.00	-0.04	-0.70	0.70	0.16	Pass
133.00	-0.04	-0.70	0.70	0.16	Pass
134.00	-0.04	-0.70	0.70	0.16	Pass
135.00	-0.04	-0.70	0.70	0.16	Pass
136.00	-0.04	-0.70	0.70	0.16	Pass
137.00	-0.04	-0.70	0.70	0.16	Pass
138.00	-0.04	-0.70	0.70	0.16	Pass
139.00	-0.04	-0.70	0.70	0.16	Pass
140.00	-0.04	-0.70	0.70	0.16	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	135,01	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

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--					

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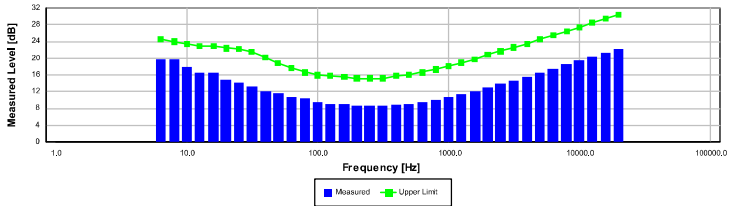
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1/3-Octave Self-Generated Noise



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--			

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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	27,08	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	-68,00	-66,00	0,01 ±	Pass
THD+N	-63,03				
-- End of measurement results--					

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-- End of Report--

Signature: _____

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CERTIFICATE OF CALIBRATION

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

Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, Bangkok 10260

Description of Equipment : Console meter

Manufacturer : Apex Instrument

Model Number : XC-572-V

Serial Number : 0807047

ID/Control No. : -

Environment Conditions : Temperature (25 ± 2) °C
Humidity (50 ± 15) % RH

Cal. Date : 17/08/2023

Issue Date : 17/08/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level



Calibrated by : Mr. San

Approved by :

(M. [Signature])
Technical Manager

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METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Run Time		Metering Console				Calibration Meter			
Elapsed	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final
(Q)	(P _{at})	(V _{at})	(V _{at})	(t _{at})	(t _{at})	(V _{wt})	(V _{wt})	(t _{wt})	(t _{wt})
min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.58	13.0	791.0910	791.2310	29	29	162.88294	163.01908	28	28
12.67	13.0	791.2310	791.3710	29	29	163.01908	163.15584	28	28
8.62	26.0	791.3820	791.5220	28	28	163.16666	163.30406	28	28
8.63	26.0	791.5220	791.6620	28	28	163.30406	163.44110	28	28
14.05	40.0	791.6690	791.9490	28	28	163.44794	163.72240	27	27
14.03	40.0	791.9490	792.2290	28	28	163.72240	163.99618	27	27
10.30	70.0	792.2430	792.5230	29	29	164.00884	164.28298	26	26
10.27	70.0	792.5230	792.8030	29	29	164.28298	164.55634	26	26
9.03	90.0	792.8150	793.0950	29	29	164.56056	164.83294	26	26
9.02	90.0	793.0950	793.3750	29	29	164.83294	165.10484	26	26



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METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data									
Results									
Standardized Data		Dry Gas Meter							
		Calibration Factor		Flowrate					
		Value	Variation	Std & Corr					
Dry Gas Meter	Calibration Meter	(Y)	(ΔY)	(Q _{sc(Std&Corr)})	(ΔH _g)	(Q _{sc(Std&Corr)})	(ΔH _g)	(Q _{sc(Std&Corr)})	(ΔH _g)
(V _{sc(Std)})	(Q _{sc(Std)})	(V _{wt(Std)})	(Q _{wt(Std)})	(Y)	(ΔY)	(Q _{sc(Std&Corr)})	(ΔH _g)	(Q _{sc(Std&Corr)})	(ΔH _g)
m ³	m ³ /min	m ³	m ³ /min			m ³ /min	mm H ₂ O	m ³ /min	mm H ₂ O
0.136	0.011	0.132	0.010	0.970	-0.001	0.010	51.902	3.446	
0.136	0.011	0.132	0.010	0.975	0.003	0.010	52.116	3.660	
0.136	0.016	0.133	0.015	0.978	0.007	0.015	47.907	-0.549	
0.136	0.016	0.133	0.015	0.975	0.004	0.015	48.345	-0.111	
0.273	0.019	0.267	0.019	0.975	0.004	0.019	49.080	0.624	
0.273	0.019	0.266	0.019	0.973	0.002	0.019	49.207	0.751	
0.275	0.027	0.267	0.026	0.971	0.000	0.026	46.382	-2.075	
0.275	0.027	0.266	0.026	0.969	-0.002	0.026	46.345	-2.111	
0.276	0.031	0.266	0.029	0.963	-0.008	0.029	46.642	-1.814	
0.276	0.031	0.265	0.029	0.962	-0.010	0.029	46.635	-1.821	
		0.971	Y Average			48.456	ΔH _g Average		

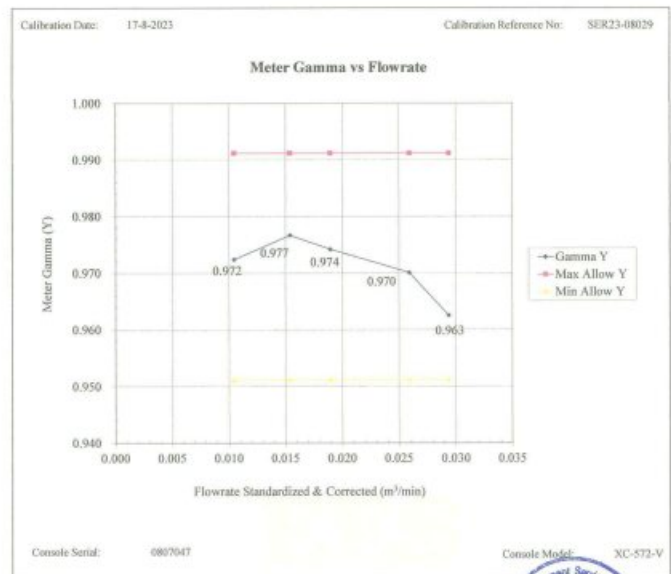
Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.

For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm) H₂O.



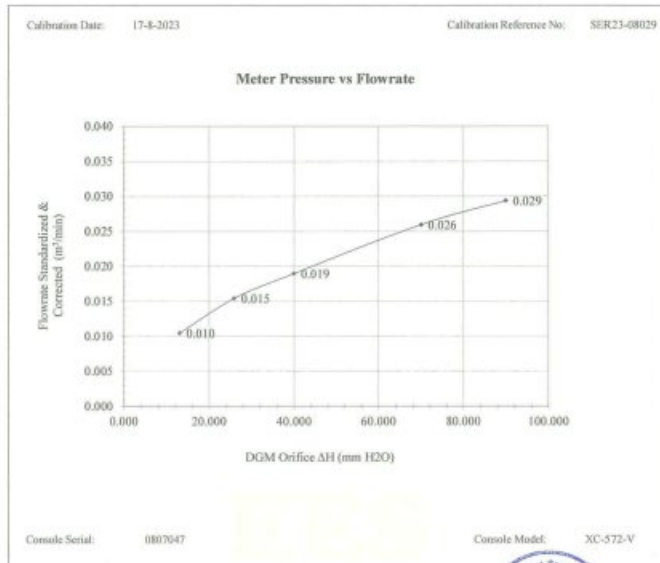
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Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74	mmHg		K _i	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



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Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	17/08/2023	09:35 AM	Std Temp	293	K
Console Serial Number	0807047	Calibration Reference No.	SER23-08029			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	756.74			K ₁	0.386	
DGM Serial Number	00003580	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



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THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	17/08/2023	02:45 PM
Console Serial Number	0807047	Calibration Reference No.	SER23-08029		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00003580	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 19777				

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-17.0	24.0	37.0	95.0	149.0	259.0	372.0	483.0	595.0	817.0	1040.0
Aux	-17.0	24.0	37.0	95.0	149.0						
Probe	-17.0	24.0	37.0	95.0	149.0						
Filter	-17.0	24.0	37.0	95.0	149.0						
Exit	-17.0	24.0	37.0								

Tolerance Range			
Stack	± 1.50%	Absolute	Meter ± 3.0 °C
Probe	± 3.0 °C		Exit ± 2.0 °C
Filter	± 3.0 °C		



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Envi Equipment Service Co., Ltd.

110/254 Moo 3, Tambon Bang Rak Phatthana, Amphur Bang Rua Thong, Nonthaburi 11110
Tel. 098 362 9152, 089 478 7885
E-mail: sales@envi-ees.com

Certificate No. : E23-08069
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CERTIFICATE OF CALIBRATION

Customer	: United Analyst and Engineering Consultant Co., Ltd.
Address	: 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong, Bangkok 10260
Description of Equipment	: Console meter
Manufacturer	: Apex Instrument
Model Number	: XC-572-V
Serial Number	: 0807048
ID/Control No.	: -
Environment Conditions	: Temperature (25 ± 2) °C Humidity (50 ± 15) % RH
Cal. Date	: 09/08/2023
Issue Date	: 09/08/2023

Calibration Method or Calibration Procedure Used

US EPA Method (United State Environmental Protection Agency)

This certificate is traceable to national standard, which realize the units of measurement according to the International System of Units (SI).

Result of Calibration

This certificate may not be reproduced other than in full except with prior Written approval of the Technical Manager, Envi Equipment Service Company Limited.

These reported uncertainties of measurement are expanded by a coverage factor of k=2, providing a 95% confidence level



Calibrated by : Mr. Sam [Signature]

Approved by : [Signature]

Technical Manager

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METHOD 5 CONSOLE CALIBRATION USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425 5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

Calibration Data										
Run Time	Metering Console					Calibration Meter				
	DGM Orifice DH	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	Volume Initial	Volume Final	Outlet Temp Initial	Outlet Temp Final	
Elapsed	(Q)	(P _a)	(V _m)	(V _{at})	(t _m)	(t _{at})	(V _{wi})	(V _{wf})	(t _w)	(t _{at})
	(Q)	(P _a)	(V _m)	(V _{at})	(t _m)	(t _{at})	(V _{wi})	(V _{wf})	(t _w)	(t _{at})
	min	mm H ₂ O	m ³	m ³	°C	°C	m ³	m ³	°C	°C
12.83		13.0	1149.315	1149.455	29	29	160.47814	160.62142	27	27
12.87		13.0	1149.455	1149.595	29	29	160.62142	160.76496	27	27
9.27		26.0	1149.606	1149.746	29	29	160.78130	160.92678	27	27
9.23		26.0	1149.746	1149.886	29	29	160.92678	161.07252	26	26
14.58		40.0	1149.894	1150.174	29	29	161.08058	161.37034	26	26
14.60		40.0	1150.174	1150.454	29	29	161.37034	161.65974	26	26
11.07		70.0	1150.467	1150.747	29	29	161.67304	161.95980	26	26
11.07		70.0	1150.747	1151.027	29	29	161.95980	162.24604	25	25
9.52		90.0	1151.038	1151.318	29	29	162.25684	162.54152	25	25
9.50		90.0	1151.318	1151.598	30	30	162.54152	162.82528	25	25



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METHOD 5 CONSOLE CALIBRATION
USING REFERENCE WET GAS METER W-NK-2.5-B-Z No.547425
5-POINT METRIC UNIT

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24 mmHg			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	

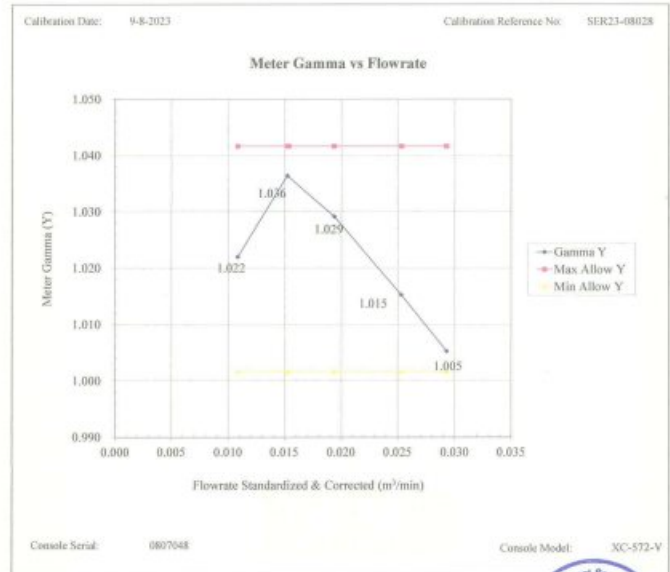
Calibration Data									
Results									
Standardized Data				Dry Gas Meter					
Dry Gas Meter		Calibration Meter		Calibration Factor		Flowrate			
(V _{std})	(Q _{std})	(V _{cal})	(Q _{cal})	Value	Variation	Std & Corr			
m ³	m ³ /min	m ³	m ³ /min	(Y)	(ΔY)	(Q _{std})	(ΔH _g)	(ΔH _g)	
0.137	0.011	0.139	0.011	1.021	-0.001	0.011	48.480	0.343	
0.137	0.011	0.140	0.011	1.023	0.001	0.011	48.556	0.419	
0.137	0.015	0.142	0.015	1.035	0.014	0.015	49.161	1.024	
0.137	0.015	0.142	0.015	1.037	0.016	0.015	48.472	0.335	
0.275	0.019	0.283	0.019	1.030	0.008	0.019	47.188	-0.949	
0.275	0.019	0.283	0.019	1.029	0.007	0.019	47.414	-0.724	
0.276	0.025	0.280	0.025	1.016	-0.005	0.025	48.836	0.699	
0.277	0.025	0.281	0.025	1.014	-0.007	0.025	48.850	0.713	
0.277	0.029	0.279	0.029	1.007	-0.015	0.029	47.137	-1.000	
0.277	0.029	0.278	0.029	1.004	-0.018	0.029	47.277	-0.860	
				1.022	Y Average			48.137	ΔH _g Average

Note: For Calibration Factor Y, the ratio of the reading of the calibration meter to the dry gas meter, acceptable tolerance of individual values from the average is ±0.02.
For ΔH_g, orifice pressure differential that equates to 0.75 cfm (0.0212 m³/min) at standard temperature and pressure, acceptable tolerance of individual values from the average is ±0.2 inches (5.1 mm).



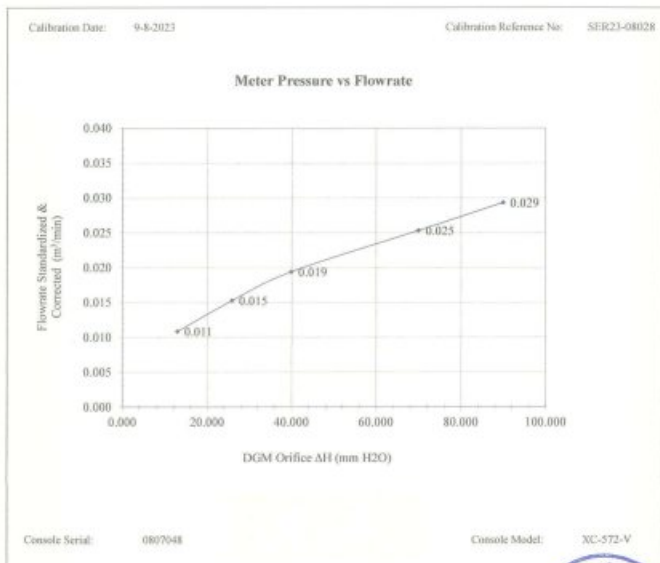
เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24 mmHg			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



เอกสารไม่ควบคุม

Meter Console Information		Calibration Conditions				Factors/Conversions		
Console Model Number	XC-572-V	Date	Time	09/08/2023	09:45 AM	Std Temp	293	K
Console Serial Number	0807048	Calibration Reference No.	SER23-08028			Std Press	760	mm Hg
DGM Model Number	SK25EX	Barometric Pressure	758.24 mmHg			K ₁	0.386	
DGM Serial Number	00003811	Calibration Meter Gamma	0.999			Console Leak Check	PASS	



เอกสารไม่ควบคุม

THERMOCOUPLES SYSTEM CALIBRATION

Sampling System Equipment Information		Calibration Conditions			
Console Model Number	XC-572-V	Date	Time	09/08/2023	11:45 AM
Console Serial Number	0807048	Calibration Reference No.	SER23-08028		
DGM Model Number	SK25EX	Reference Thermometer	DIGICON		
DGM Serial Number	00003811	Serial Number	183169105		
Meter Box Model Number	JENCO 765 KF				
Meter Box Serial Number	JC 08944				

Results											
Console Thermocouple Simulator											
Channel and test point	Meter Box Channel Temperature Reading (°C)										
	-18.0	25.0	38.0	93.0	149.0	260.0	371.0	482.0	593.0	816.0	1038.0
Stack	-19.0	24.0	37.0	92.0	148.0	257.0	370.0	481.0	593.0	815.0	1038.0
Aux	-19.0	23.0	37.0	92.0	147.0						
Probe	-19.0	23.0	37.0	92.0	148.0						
Filter	-19.0	23.0	37.0	92.0	147.0						
Exit	-18.0	23.0	37.0								

Tolerance Range			
Stack	± 1.50%	Absolute	Meter ± 3.0 °C
Probe	± 3.0 °C		Exit ± 2.0 °C
Filter	± 3.0 °C		



เอกสารไม่ควบคุม

MULTI-POINT GAS TEST REPORT

Test Date : Jan 25, 2023

Equipment : Hydrocarbon Analyzer Model : 551
Manufacturer : Thermo SCIENTIFIC Serial Number : 1182920025

Standard Gas Concentration

Sulphur Dioxide (SO₂) : PPM
Nitric Oxide (NO) : PPM
Methane (CH₄) : 39.8 PPM
Carbon Monoxide (CO) : PPM
Cylinder No. : D924432
Expiration Date : Aug 4, 2028

Dilutor Detail

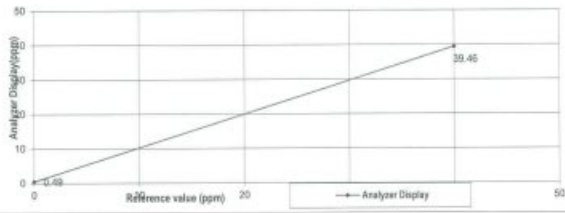
Manufacturer :
Model :
Serial Number :

Multi-point gas test data

Reference Value (ppm)	Analyzer Display (ppm)	Difference Error	Percent Error	% Error
Level 1 Zero	0.00	0.49	0.49	0.49
Level 2 80.00%	40.00	39.46	-0.54	-1.37
Remark : Measuring Range	50.00 ppm		Average Difference (%)	0.93

Acceptable Limit $\pm 5\%$

Multi-Point Gas Test Chart



Calculate by

25.1.66

Approve by

26. Jan. 2023

Page 1 of 1

เอกสารไม่ควบคุม

THE LINDE GROUP

Certificate Of Analysis
Special Gases Mixture

Customer Details
Name: United Analyst & Engineering Co., Ltd.
Address: 3 Soi Udomsuk 41, Sukhumvit Rd., Bang Chak, Khet Phra Khanong, Bangkok 10260
Customer Tag No.:

Certificate Details
Number: 3384/29
Date of Issue: 4-Aug-2020
Expiry Date: 4-Aug-2028
Material Details: 90161442
Production Order: 400400-AL-34
Material Code: 0824432
Gas content: 6.60 M³
Filling pressure: 137.0 bar
Valve: CGA 510 BRASS
Cylinder Owner: LINDE
Cylinder Material: Aluminum
Cylinder Size: 50 L

Laboratory Report
Component: Methane
Normal Concentration: 40.0 ppm
Analysis Result: 39.8 ppm
Uncertainty: $\pm 1\%$ relative
Method of Analysis: (S) I-PH-012
Assay Date: 4-Aug-2020

Reference Standard used in Assay
Reference Standard: Methane in Nitrogen
Cylinder number: 2559956
Concentration: 49.29 \pm 0.39 ppm
Expiry date: 4-Oct-2020

Instrument/Make/Model: FTIR Spectrometers Nicolet 650
Analytical Instruments used in Assay: Analytical Principle FTIR-CH4
Last Multi-point Calibration: 4-Aug-2020

Recommend usage condition
Minimum utilization: 5% of actual content or before expiry date whichever comes first.
Storage condition: Keep in well ventilation and secure area.
Comments: When reordering, please quote the material number.

Note:
1. All results expressed in this report are on a molar basis, unless otherwise specified. The Assay of this Standard has been performed in accordance with the O2 Analytical Protocol (IPA 400/12/12) for the Assay and Certification of Gaseous Calibration Standards using gravimetry (G).
2. The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor (k=2), providing a level of confidence of approximately 95%. The measurement of this material is traceable to the SI through the reference gas standard which is traceable to two National Standard of Mass as well as recognized national weighing methods.
3. (1) Gas Chromatography, (2) Magnetic Oxygen Analysis, (3) Electrochemical Oxygen Analysis, (4) Electrochemical Methanol Analysis, (5) Total Hydrocarbon Analysis, (6) Other - Specified.

Sukanya Panyasakorn
Signatory for and on behalf of Linde (Thailand) Co., Ltd.

Page 1 of 1
This report shall not be reproduced except in full.

United Analyst and Engineering Consultant Co., Ltd.
No. 15 Udomsuk 41, Sukhumvit Rd., Bang Chak, Khet Phra Khanong, Bangkok 10260
Tel: (66) 2763 2828 Fax: (66) 2763 2800
E-mail: uae@uaeconsultant.com

Linde (Thailand) Public Company Limited
151/151, Bangkok Road, 101, Bangkok 101, Thailand
Tel: (66) 2384 4331 Fax: (66) 2384 4330
E-mail: linde@linde.co.th

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No: G 670083
Date of issue : 08-Feb-24

Instrument description : Flue Gas Analyzer
Instrument model : Testo 350 New
Control unit serial no. : 03099393/701
Instrument serial no. : 60899698/701
ID no. or control no. : UAE.FPM.008/2560
Manufacturer : Testo SE & Co. KGaA
Probe description :
Probe model :
Probe serial no. :
Customer name : UNITED ANALYST CONSULTANT CO., LTD.
Customer address : 81 SOI UDOMSUK 41, SUKHUMVIT ROAD, BANGCHAK PRAKHONG BANGKOK 10260

Total pages of certificate : 2 Pages
Receiving no. : L-240430
Receiving date : 05-Feb-24
Parameter of calibration : Gas Calibration (Oxygen 2.50, 10.04, 21.02 %vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 30.34, 81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory
Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yaek 48, Toongsonghong, Lakki, Bangkok 10210

Calibration procedure no.: This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-38-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement Multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and the results relate only to the items tested/calibrated.

This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 08-Feb-24

Mr. Kwanchai
Calibration Technician

Mrs. Nongluck
Technical Manager

เอกสารไม่ควบคุม



Calibration Certificate

Certificate No.: G 670083

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O ₂) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O ₂) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O ₂) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO ₂) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO ₂) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO ₂) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	22-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO ₂) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO ₂) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 23.5 °C Humidity : 64.1 %RH Pressure : 1011.7 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,200 ml/min Gas pressure : 1016.4 mbar

Calibration Results (Without adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O ₂ (%Vol)	2.50	2.57	0.07	0.15
O ₂ (%Vol)	10.04	10.09	0.05	0.20
O ₂ (%Vol)	21.02	21.08	0.06	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	302	0	6.0
CO (ppm)	1003	1002	-1	12
NO ₂ (ppm)	30.34	30.2	0.14	8.0
NO ₂ (ppm)	81.32	82.4	1.08	8.0
NO ₂ (ppm)	201.9	202.8	0.9	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	150	-1.5	8.0
NO (ppm)	322.5	320	-2.5	12
SO ₂ (ppm)	50.36	49	-1.36	6.0
SO ₂ (ppm)	100.8	100	-0.8	6.0
SO ₂ (ppm)	600.8	599	-1.8	13

Remark : 1 cmol/mol = 1 %vol, 1 μmol/mol = 1 ppm.

End of Report

เอกสารไม่ควบคุม

Certificate No: G 670125
Date of issue : 23-Feb-24

Instrument description : Flue Gas Analyser
Instrument model : Testo 350 New
Control unit serial no. : 00349608/0419
Instrument serial no. : 61658816/0419
ID no. or control no. : UAE.EFM.123/2562 (No.9)
Manufacturer : Testo SE & Co. KGaA
Probe description : -
Probe model : -
Probe serial no. : -
Customer name : United Analyst and Engineering Consultant Co., Ltd.
Customer address : 81 Soi Udomsuk 41, Sukhumvit Road., Bangchak, Prakanong, Bangkok 10260

Total pages of certificate : 3 Pages
Receiving no. : L-240605
Receiving date : 19-Feb-24
Parameter of calibration : Gas Calibration (Oxygen 2.50, 10.04, 21.02 %Vol, Carbon Monoxide 80.14, 302, 1003 ppm, Nitrogen Dioxide 30.34, 81.32, 201.9 ppm, Nitric Oxide 30.01, 151.5, 322.5 ppm, Sulphur Dioxide 50.36, 100.8, 600.8 ppm)

Condition of UUC : Used
Ambient condition : All of the Measurement were carried out the stabilized laboratory

Temperature : 23 ± 5 °C
Humidity : 55 ± 15 %RH

Calibration place : 17/121 Soi Ngamwongwan 47 Yeak 48, Toongsonghong, Lakse, Bangkok 10210

Calibration procedure no. : This instrument was calibrated by comparison with Standard gas mixture according to calibration Work Instruction no. WI-CL-28-C

The calibration certificate expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by coverage factor $k=2$, which for a normal distribution corresponds to a coverage probability of approximately 95%. This certificate is applied only to item under test Environmental condition.

This Calibration Certificate may not be reproduced other than in full except with the permission of the issuing laboratory. Calibration certificates without signature and seal not valid and The results relate only to the items tested/calibrated.

This calibration certificate documents are traceability to national standards, which realize measurement according to the International System of Units (SI).

Date of calibration : 23-Feb-24


Mr. Kwanchai
Calibration Technician


Mrs. Nongluck
Technical Manager

FM-CL-09-C Rev.8

Page 1 of 3

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yeak 48, Toongsonghong, Lakse, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Tax ID : 0106536035591 www.entech.co.th

เอกสารไม่ควบคุม

Certificate No.: G 670125

Calibration Results (After adjustment) (Table 3)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.500	2.52	0.02	0.15
O2 (%Vol)	10.04	9.93	-0.11	0.20
O2 (%Vol)	21.02	21.14	0.12	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1003	1003	0	12
NO2 (ppm)	30.34	32.2	1.86	8.0
NO2 (ppm)	81.32	83.5	2.18	8.0
NO2 (ppm)	201.9	200.6	-1.3	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	150	-1.5	8.0
NO (ppm)	322.5	320	-2.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.8	100	-0.8	6.0
SO2 (ppm)	600.8	598	-2.8	13

Remark : 1 cmol/mol = 1 %vol, 1 µmol/mol = 1 ppm.

End of Report

FM-CL-09-C Rev.8

Page 3 of 3

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yeak 48, Toongsonghong, Lakse, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Tax ID : 0106536035591 www.entech.co.th

เอกสารไม่ควบคุม

Certificate No.: G 670125

Standard References (Table 1)

Standard	Certificate No.	Vendor	Due date
Oxygen (O2) 2.50 % Vol	2412/23	Linde	27-Aug-27
Oxygen (O2) 10.04 % Vol	CG-0153-21	Nimt	18-Nov-26
Oxygen (O2) 21.02 % Vol	CG-0041-22	Nimt	10-Feb-27
Carbon monoxide (CO) 80.14 ppm	CG-0040-22	Nimt	14-Feb-27
Carbon monoxide (CO) 302 ppm	1915/23	Linde	16-Jun-25
Carbon monoxide (CO) 1003 ppm	2584/23	Linde	10-Sep-25
Nitrogen Dioxide (NO2) 30.34 ppm	2703/22	Linde	22-Aug-24
Nitrogen Dioxide (NO2) 81.32 ppm	3546/23	Linde	14-Jan-26
Nitrogen Dioxide (NO2) 201.9 ppm	1975/23	Linde	17-Jul-25
Nitric Oxide (NO) 30.01 ppm	CG-0014-23	Nimt	19-Feb-25
Nitric Oxide (NO) 151.5 ppm	0161/23	Linde	23-Jan-25
Nitric Oxide (NO) 322.5 ppm	1974/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 50.36 ppm	2004/23	Linde	17-Jul-25
Sulphur Dioxide (SO2) 100.8 ppm	3507/22	Linde	09-Nov-24
Sulphur Dioxide (SO2) 600.8 ppm	2003/23	Linde	17-Jul-25

Measured room conditions

Temperature : 22.9 °C Humidity : 62.2 %RH Pressure : 1009.4 mbar

Calibration conditions

Gas Temperature : 23 °C Flow rate : 1,100 ml/min Gas pressure : 1019.2 mbar

Calibration Results (Before adjustment) (Table 2)

Parameter of Standard	Standard Values	Mean of UUC	Error	Uncertainty (±)
O2 (%Vol)	2.50	2.52	0.02	0.15
O2 (%Vol)	10.04	9.93	-0.11	0.20
O2 (%Vol)	21.02	21.14	0.12	0.30
CO (ppm)	80.14	81	0.86	3.0
CO (ppm)	302	303	1	6.0
CO (ppm)	1003	1003	0	12
NO2 (ppm)	30.34	32.2	1.86	8.0
NO2 (ppm)	81.32	83.5	2.18	8.0
NO2 (ppm)	201.9	200.6	-1.3	12
NO (ppm)	30.01	29	-1.01	8.0
NO (ppm)	151.5	150	-1.5	8.0
NO (ppm)	322.5	320	-2.5	12
SO2 (ppm)	50.36	50	-0.36	6.0
SO2 (ppm)	100.8	100	-0.8	6.0
SO2 (ppm)	600.8	598	-2.8	13

FM-CL-09-C Rev.8

Page 2 of 3

Issued Date 26/02/16

Entech Industrial Solution Co., Ltd.

17/121 Soi Ngamwongwan 47 Yeak 48, Toongsonghong, Lakse, Bangkok 10210 THAILAND Tel: 0-2779-8888 Calibration@entech.co.th
Tax ID : 0106536035591 www.entech.co.th

เอกสารไม่ควบคุม



Certificate of Calibration

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

Certificate No : 24-TPM-146
Request No : Req-2024-0541
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPW020001
Resolution : 0.1 °C
ID Number : UAE.EFM.121/2565

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 5 March 2024
Calibrated Date : 21 March 2024

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12090077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No. : QR23-2574
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :
Mr. Noppadol
Technical Manager
Issue Date : 21 March 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : Not Adjust

Certificate No :

24-TPM-146

Request No : Req-2024-0541

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	ITC Reading (°C)	Correction (°C)	Uncertainty (k=2)
WET	20.030	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.035	30.2	-0.2	0.13
	35.036	35.2	-0.2	0.13
	40.039	40.2	-0.2	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
DRY	20.031	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.034	30.1	-0.1	0.13
	35.036	35.2	-0.2	0.13
	40.039	40.2	-0.2	0.13
	45.039	45.1	-0.1	0.13
	50.043	50.1	-0.1	0.13
	60.047	60.1	-0.1	0.13
GLOBE	20.032	20.2	-0.2	0.13
	25.033	25.2	-0.2	0.13
	30.034	30.2	-0.2	0.13
	35.037	35.2	-0.2	0.13
	40.039	40.2	-0.2	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.048	60.2	-0.2	0.13

End of Certificate

Calibrated By :
Mr. Satchok

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
เอกสารไม่ควบคุม



Certificate of Calibration

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

Certificate No : 24-TPM-152
Request No : Req-2024-0542
Page : 2/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : TSI QUEST
Model : QT-32
Serial Number : TPQ020025
Resolution : 0.1 °C
ID Number : UAE.EFM.008/2559

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 5 March 2024
Calibrated Date : 21 March 2024

Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/GINGO, Model: GT11/RTD100, SN: 12090077, ID: AR-TPM Which was calibrated on 27 October 2023, Calibration Certificate No. : QR23-2574
Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.: Calibration 0292

Note

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

Approved By :
Mr. Noppadol
Technical Manager
Issue Date : 21 March 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
เอกสารไม่ควบคุม

Calibration Note

UUC Adjustment : Not Adjust

Certificate No :

24-TPM-152

Request No : Req-2024-0542

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	ITC Reading (°C)	Correction (°C)	Uncertainty (k=2)
WET	20.036	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.035	30.1	-0.1	0.13
	35.036	35.1	-0.1	0.13
	40.039	40.2	-0.2	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.047	60.2	-0.2	0.13
DRY	20.031	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.039	40.1	-0.1	0.13
	45.039	45.1	-0.1	0.13
	50.043	50.1	-0.1	0.13
	60.047	60.1	-0.1	0.13
GLOBE	20.032	20.1	-0.1	0.13
	25.033	25.1	-0.1	0.13
	30.034	30.1	-0.1	0.13
	35.037	35.1	-0.1	0.13
	40.039	40.1	-0.1	0.13
	45.041	45.2	-0.2	0.13
	50.044	50.2	-0.2	0.13
	60.048	60.2	-0.2	0.13

End of Certificate

Calibrated By :
Mr. Satchok

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer.
เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 23-TPM-373
Request No : Req-2023-1529
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Thermal Environment Monitor
Manufacturer : Quest Technologies
Model : QT-34
Serial Number : TEK120020
Resolution : 0.1 °C
ID Number : UAE.EMA2.023/2555

Range Calibration : 20 °C to 60 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 4.5
Calibration Position (mm) : 67.5
Instrument Status : Used

Calibration Environment and Details


Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 21 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-TPM-01 by Comparison with Standard Thermometer.

Reference Standard : Digital Thermometer with Sensor, Manufacturer: GINGO/INGO, Model: GT11/RTD100, SN:
08000057, ID: 02-TPM Which was calibrated on 27 February 2023, Calibration Certificate No. : QR23-
0494

Traceability : This Certificate is traceable to SI Unit through Quality Reborn Co., Ltd., NSC-ONSC Accreditation No.:
Calibration 0292

Note

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

Approved By : 
Mr. Noppadon
Technical Manager
Issue Date : 7 August 2023


Certificate No : 23-TPM-373
Request No : Req-2023-1529
Page : 2/2

Calibration Note
UUC Adjustment : Not Adjust

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty to °C
WET	20.032	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.035	30.0	0.0	0.13
	35.036	35.0	0.0	0.13
	40.038	40.0	0.0	0.13
	45.041	45.0	0.0	0.13
	50.044	50.0	0.0	0.13
	60.047	60.0	0.0	0.13
DRY	20.031	19.9	+0.1	0.13
	25.032	24.9	+0.1	0.13
	30.033	29.9	+0.1	0.13
	35.038	34.9	+0.1	0.13
	40.038	39.9	+0.1	0.13
	45.040	44.9	+0.1	0.13
	50.043	49.9	+0.1	0.13
	60.047	59.9	+0.1	0.13
GLOBE	20.034	20.0	0.0	0.13
	25.033	25.0	0.0	0.13
	30.034	29.9	+0.1	0.13
	35.035	34.9	+0.1	0.13
	40.044	39.9	+0.1	0.13
	45.040	44.9	+0.1	0.13
	50.042	50.0	0.0	0.13
	60.048	60.0	0.0	0.13

End of Certificate

Calibrated By : 
Mr. Stichok

เอกสารไม่ควบคุม

เอกสารไม่ควบคุม

Certificate of Calibration

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

Certificate No : 23-NDM-179
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143225
ID : -
Resolution : 0.1 dB

Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 139831
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN.	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSL
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Size Generator	Svantek	Svan401	131	12 October 2023	WK Electric
Timer	EXTECH	-	65-NCT	20 March 2024	TPA

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 : 
Mr. Noppadon
Calibration Officer
Approved By : 
Mr. Pae
Calibration Engineer Supervisor
Issue Date : 7 August 2023

Certificate No : 23-NDM-179
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY (%)	Tolerances Limit (%)
	Ref	UUC	Ref (Pa ¹ h)	UUC (Pa ² h)	Error (%)		
FAST / A / 55-140							
Calibrator Setting	(s)	(s)					
1000 Hz 114 dB	120	120	3.18	3.13	-1.57	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY (± dB)	Tolerances Limit (± dB)
	A	C		
FAST / 55-140				
STD Setting	(dB)	(dB)		
563 Hz	0.0	0.1	0.40	2.0
125 Hz	0.7	0.9	0.40	1.5
250 Hz	0.3	0.8	0.40	1.5
500 Hz	0.3	0.7	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	-0.6	-0.2	0.40	2.0
4000 Hz	2.3	2.4	0.40	3.0
8000 Hz	-2.9	-2.9	0.40	5.0

Certificate No : 23-NDM-179
Request No : Req-2023-1488

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
Level A	(dB)	54.5	80.1	90.1	100.1	110.1	114.0	120.0	130.0	140.0	
Error	(dB)	-0.5	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)	88.9	98.9	108.9	112.9	118.9	128.9	138.9		
Level A	(dB)	89.0	98.9	108.9	112.9	118.9	128.9	138.9			
Error	(dB)	0.1	0.0	0.0	0.0	0.0	0.0	0.0	-0.1		
63 Hz	Ref	(dB)	87.8	93.8	103.8	113.8					
Level A	(dB)	87.8	93.8	103.8	113.8						
Error	(dB)					0.0	0.0	0.0	0.0		
Tolerances Limit		(dB)	1.0								
UNCERTAINTY		(dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	Limit		
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)	
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26	
1000 Hz 110 dB	45	45	0.50	0.50	0.00			
1000 Hz 110 dB	90	90	1.00	1.01	+1.00			
1000 Hz 110 dB	180	180	2.00	2.02	+1.00			
1000 Hz 120 dB	36	36	4.00	4.03	+0.75			
1000 Hz 120 dB	72	72	8.00	8.05	+0.63			
1000 Hz 120 dB	90	90	10.00	9.90	-1.00	5.6		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10			
1000 Hz 120 dB	360	360	40.00	40.34	+0.85			
1000 Hz 120 dB	720	720	80.00	80.49	+0.61			

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Certificate No : 23-NDM-179
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)		
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29	+0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting		Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error	(%)		
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00		5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00			-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00			-29 ~ +41

5. Response to unipolar pulse

UUC Setting		Time		Exposure Measurement		UNCERTAINTY	Tolerances Limit
FAST / A / 55-140	Ref	UUC	Ref	UUC	Different	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Continuous Rectangle +	29		10.37		0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.37				

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 23-NDM-187
Request No : Req-2023-1488

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 143233
ID : -
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV 27
Microphone S/N : 132041
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : New

Calibration Environment and Details


Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 12 July 2023
Calibrated Date : 7 August 2023
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic


Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Quest-cal	188272	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	6 October 2023	GRAS
Sine Generator	Svanick	Svan401	131	12 October 2023	WK Electric
Timer	EXTECH	-	05-ACT	20 March 2024	TPA

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 : 
Mr. Noppadol
Calibration Officer

Approved By : 
Mr. P
Calibration Engineer Supervisor
Issue Date : 7 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-187
Request No : Req-2023-1488

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.57	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN: 58079

2. Frequency weightings

UUC Setting		Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
FAST / 55-140	A	C	(± dB)		
STD Setting	(dB)	(dB)	(± dB)	(± dB)	(± dB)
63 Hz	0.2	0.3	0.40	2.0	
125 Hz	0.0	0.5	0.40	1.5	
250 Hz	-0.2	0.3	0.40	1.5	
500 Hz	-0.1	0.3	0.40	1.5	
1000 Hz	0.0	0.0	0.40	-	
2000 Hz	-0.1	0.3	0.40	2.0	
4000 Hz	0.8	0.9	0.40	3.0	
8000 Hz	-1.7	-1.7	0.40	5.0	

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-187
Request No : Req-2023-1488

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High										
	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
1000 Hz	Ref	(dB)	54.7	80.4	90.1	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	-0.3	0.4	0.1	0.0	0.0	0.0	0.0	0.0	0.0
	Error	(dB)									
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)			0.0	0.0	0.0	-0.1	-0.1	-0.1	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)						0.0	0.0	0.0	0.0
Tolerances Limit		(dB)	1.0								
UNCERTAINTY		(dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	0.99	-1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	-21, +26
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovation Instrument Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate No : 23-NDM-187
Request No : Req-2023-1488

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29, +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21, +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29, +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29, +41

5. Response to unipolar pulse

UUC Setting	Time	Exposure Measurement		UNCERTAINTY	Tolerances
FAST / A / 55-140	UUC	UUC	Different		Limit
Calibrator Setting	(s)	(Pa ² h)	(%)	(%)	(%)
Continuous Rectangle +	29	10.13	0.00	3.7	-21 ~ +26
Continuous Rectangle -		10.13			

* Indicates non accredited

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovation Instrument Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : R1 Soi Laksamuk 41, Sukhumvit Road, Bangchak, Prakanong, Bangkok 10260
Certificate No : 24-NDM-108
Request No : Req-2024-0833

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117694
ID : UAE-ETM.116-2565
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone S/N : 112805
Preamplifier Model : -
Preamplifier S/N : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50%RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 10 April 2024
Calibrated Date : 26 April 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Multifrequency Calibrator	Quest	Quest-cal	FFA000214	25 July 2024	TSI
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svsmok	Svsm01	131	9 October 2024	WK Electric
Timer	EXTECH	-	05-AC1	14 March 2025	TPA

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 : 
Mr. Noppad
Service Calibration Engineer
Approved By : 
Mr. Pait
Calibration Engineer Supervisor
Issue Date : 26 April 2024

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovation Instrument Calibration Laboratory.

เอกสารไม่ควบคุม

Certificate No : 24-NDM-108
Request No : Req-2024-0833

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(± dB)	(± dB)
*63 Hz	0.1	0.1	0.40	2.0
125 Hz	-0.2	-0.1	0.40	1.5
250 Hz	-0.2	-0.1	0.40	1.5
500 Hz	-0.2	0.0	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.2	0.2	0.40	2.0
4000 Hz	2.1	2.1	0.40	3.0
8000 Hz	0.6	0.6	0.40	5.0

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovation Instrument Calibration Laboratory.

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Certificate No : 24-NDM-108
Request No : Req-2024-0833

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UUC Setting	FAST / A / High											
	Ref	(dB)	55.0	80.0	80.0	100.0	110.0	114.0	120.0	130.0	140.0	
1000 Hz	Level A	(dB)	54.4	80.1	80.1	100.1	110.0	114.0	120.0	130.0	140.0	
	Error	(dB)	-0.6	0.1	0.1	0.1	0.0	0.0	0.0	0.0	0.0	
8000 Hz	Ref	(dB)				88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)				88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)				0.0	0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)					87.8	93.8	103.8	113.8		
	Level A	(dB)					87.8	93.8	103.8	113.8		
	Error	(dB)					0.0	0.0	0.0	0.0		
Tolerances Limit		(±dB)	±0.3									
UNCERTAINTY		(±dB)	0.3									

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 119 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	9.90	-1.00		
1000 Hz 120 dB	180	180	20.00	19.76	-1.20		
1000 Hz 120 dB	360	360	40.00	39.42	-1.45		
1000 Hz 120 dB	720	720	80.00	78.66	-1.68		

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

เอกสารไม่ควบคุม
P34-708-NDM-01 Rev.02 Issue date: 7/11/23

Certificate No : 24-NDM-108
Request No : Req-2024-0833

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)	(Pa ² h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 ~ -0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)
Continuous Rectangle +	29		10.13		±2.37	±3.7
Continuous Rectangle -			10.37			

* Indicates non accredited

End of Certificate

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

เอกสารไม่ควบคุม
P34-708-NDM-01 Rev.02 Issue date: 7/11/23

Certificate of Calibration

Customer

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

Certificate No : 24-NDM-109
Request No : Req-2024-0834

Unit Under Calibration Details

Measurement item : Noise Dosimeter
Manufacturer : SVANTEK
Model : SV 104
Serial Number : 117730
ID : UAE.EFM.119.2545
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : SV27
Microphone SN : 77162
Preamplifier Model : -
Preamplifier SN : -
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 10 April 2024
Calibrated Date : 26 April 2024
Calibration Procedure : In-house method CP-NDM-01 based on IEC 61252 : 2017
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Multi-frequency Calibrator	Quest	Questval	EF4600234	25 July 2024	TSE
Standard Microphone	GRAS	40AN	188273	21 August 2024	GRAS
Sine Generator	Svanick	Svan401	131	9 October 2024	WK Electric
Timer	EXTech	-	05-ACT	14 March 2025	TPA

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 : 
Mr. Noppa
Service Calibration Engineer

Approved By : 
Mr. Pui
Calibration Engineer Supervisor
Issue Date : 26 April 2024

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

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P34-708-NDM-01 Rev.02 Issue date: 7/11/23

Certificate No : 24-NDM-109
Request No : Req-2024-0834

1. Absolute acoustical sensitivity

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² h)	(Pa ² h)	(%)	(%)	(%)
1000 Hz 114 dB	120	120	3.18	3.13	-1.6	3.1	-21, +26

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58079

2. Frequency weightings

UUC Setting	Deviation from various Frequency Weighting		UNCERTAINTY	Tolerances Limit
	A	C		
FAST / 55-140	(dB)	(dB)	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(± dB)	(± dB)
63 Hz	-0.1	-0.1	0.40	2.0
125 Hz	0.0	0.2	0.40	1.5
250 Hz	0.0	0.1	0.40	1.5
500 Hz	0.0	0.1	0.40	1.5
1000 Hz	0.0	0.0	0.40	-
2000 Hz	0.2	0.2	0.40	2.0
4000 Hz	1.5	1.5	0.40	3.0
8000 Hz	0.4	0.4	0.40	5.0

The results related only to the items calibrated. The certificate shall not be reproduced except in full, without written approval of the

เอกสารไม่ควบคุม
P34-708-NDM-01 Rev.02 Issue date: 7/11/23

Certificate No : 24-NDM-109
Request No : Req-2024-0834

3. Linearity of response to steady signals

a. Sound exposure meter, linearity of response for changes of input sinusoidal signal level

UFC Setting		FAST / A / High									
1000 Hz	Ref	(dB)	55.0	80.0	90.0	100.0	110.0	114.0	120.0	130.0	140.0
	Level A	(dB)	54.7	80.1	90.1	100.0	110.0	114.0	120.0	130.0	140.0
	Error	(dB)	-0.3	0.1	0.1	0.0	0.0	0.0	0.0	0.0	0.0
8000 Hz	Ref	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Level A	(dB)			88.9	98.9	108.9	112.9	118.9	128.9	138.9
	Error	(dB)				0.0	0.0	0.0	0.0	0.0	-0.1
63 Hz	Ref	(dB)						87.8	93.8	103.8	113.8
	Level A	(dB)						87.8	93.8	103.8	113.8
	Error	(dB)							0.0	0.0	0.0
Tolerances Limit		(±dB)	1.0								
UNCERTAINTY		(±dB)	0.3								

b. Sound exposure meter linearity of error

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances
FAST / A / 55-140	Ref	UUC	Ref	UUC	Error		Limit
Calibrate Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
1000 Hz 110 dB	27	27	0.30	0.30	0.00	5.6	-21, +26
1000 Hz 110 dB	45	45	0.50	0.50	0.00		
1000 Hz 110 dB	90	90	1.00	1.01	+1.00		
1000 Hz 110 dB	180	180	2.00	2.02	+1.00		
1000 Hz 120 dB	36	36	4.00	4.03	+0.75		
1000 Hz 120 dB	72	72	8.00	8.05	+0.63	5.6	
1000 Hz 120 dB	90	90	10.00	10.13	+1.30		
1000 Hz 120 dB	180	180	20.00	20.22	+1.10		
1000 Hz 120 dB	360	360	40.00	40.34	+0.85		
1000 Hz 120 dB	720	720	80.00	80.49	+0.61		

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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FM-708-NDM-01 Rev.02 Issue date 11/11/21

4. Response to short duration

a. Response for sinusoidal signals - reference level

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)	(Pa ² /h)
4000 Hz 95 dB	2846	2846	1.00	1.00	0.00	0.052	-0.29 ~ +0.41

b. Sound exposure meter response for series of toneburst impulses

UUC Setting	Time		Exposure Measurement			UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC	Error		
FAST / A / 55-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)	(%)
Burst 1 ms, 95 dB	2846	2846	1.00	1.00	0.00	5.6	-21 ~ +26
Burst 1 ms, 100 dB	900	900	1.00	1.00	0.00		-29 ~ +41
Burst 1 ms, 108 dB	143	143	1.00	1.01	+1.00		-29 ~ +41

5. Response to unipolar pulse

UUC Setting	Time		Exposure Measurement		UNCERTAINTY	Tolerances Limit
	Ref	UUC	Ref	UUC		
FAST / A / 55-140	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)
Calibrator Setting	(s)	(s)	(Pa ² /h)	(Pa ² /h)	(%)	(%)
Continuous Rectangle +	29		10.13	0.00	3.7	-21 ~ +26
Continuous Rectangle -			10.13			

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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FM-708-NDM-01 Rev.02 Issue date 11/11/21

Certificate of Calibration

Customer

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

Certificate No : 23-ACT-114
Request No : Req-2023-1543

Unit Under Calibration Details

Measurement item : Acoustic Calibrator
Manufacturer : SVANTEK
Model : SV 35
Serial Number : 44783
ID : UAE.EFM.019/2559

Class : 1
Range : 94 , 114 dB / 1000 Hz
Instrument Status : Used

Calibration Environment and Details


Temperature : (23 ±2 °C)
Humidity : (50 ± 20 %RH)
Barometric Pressure : (1013 ±10.0 hPa)
Received Date : 21 July 2023
Calibration Date : 4 August 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	EEL	31 May 2024
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 : 
Mr. Noppadon
Service Calibration Engineer

Approved By : 
Mr. Pachi
Calibration Engineer Supervisor
Issue Date : 4 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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FM-708-NDM-01 Rev.02 Issue date 11/11/21

Certificate No : 23-ACT-114
Request No : Req-2023-1543

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Error	Measured	Error		
94 dB / 1000 Hz	94.25	0.25	-	-	0.13	0.25
114 dB / 1000 Hz	114.19	0.19	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Error (%)	Measured (Hz)	Error (%)		
94 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70
114 dB / 1000 Hz	1000.00	0.00	-	-	0.01	0.70

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

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (%)		Measured (%)			
94 dB / 1000 Hz	0.04		-	-	0.40	2.5
114 dB / 1000 Hz	0.02		-	-	0.40	2.5

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

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the

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FM-708-NDM-01 Rev.02 Issue date 11/11/21

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RJON
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00558036 / 176346 / 47891
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 06 JANUARY 2023
Calibration Date : 10-12 JANUARY 2023
Date of Issue : 16 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by : 
(Thanakul)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced
other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23027
Job No. : VC66AC0023
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23027
Job No. : VC66AC0023
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference
Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL.BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL.BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL.BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

3.1 National Institute of Metrology (Thailand).

3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23027
Job No. : VC66AC0023
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.4

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	12.0
C - weight	18.1
Flat	23.9

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.2	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.0	0.1	0.1	± 5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23027
Job No. : VC66AC0023
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.0	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	94.0	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch...

Continuation of Calibration Certificate

Cert. No. : ACL23027
Job No. : VC66AC0023
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch...

Continuation of Calibration Certificate

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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	53.9	-0.1	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	38.9	-0.1	± 1.1
34.0	34.0	0.0	± 1.1
30.0	29.9	-0.1	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	27.9	-0.1	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

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เอกสารไม่ควบคุม

T. Petch...

Continuation of Calibration Certificate

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11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.7	89.6	-0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch...

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch...

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42 / Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709651 / 188529 / 00801
ID No.: -

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location : -
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 06 JANUARY 2023
Calibration Date : 10-12 JANUARY 2023
Date of Issue : 16 JANUARY 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

T. P. S.
(Thanakul Pisutpaisan)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0007-22	04-Feb-23
Waveform Generator	33511B	MY52302742	EF-0008-22	04-Feb-23
Digital Multimeter	33461A	MY53220104	EEL-BP. 04/0265	09-Feb-23
Digital Multimeter	33461A	MY53220076	EEL-BP. 03/0265	09-Feb-23
Digital Multimeter	34461A	MY60024273	EEL-BP. 05/0265	09-Feb-23
Programmable Attenuator	MAT-1070	62100114	EF-0009-22	07-Feb-23
Condenser Microphone	4180	2977900	AA-1013-22	24-Feb-23
Measuring Amplifier	NA-42KAI	34560495	AA-3005-22	22-Feb-23

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.4	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long-term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A-weight	21.1
C-weight	27.7
Flat	32.4

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.6	0.5	0.5	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	0.6	0.6	0.6	± 5.0

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เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23029
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4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	0.0	-0.1	±2.0
125	0.0	0.1	-0.1	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.1	-0.1	±1.5
1000	0.1	0.1	0.0	±1.0
2000	0.1	0.1	0.0	±2.0
4000	0.1	0.1	0.0	±3.0
8000	0.1	0.1	0.0	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	0.0	-
C - weight	94.0	0.0	± 0.2
Flat	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	0.0	-
Slow	93.9	0.0	± 0.1
Leq	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.1	0.1	± 0.3

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23029
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	116.9	-0.1	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.8	-0.2	1.5 ; -5.0
	2	8	108.0	107.9	-0.1	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, Lpeak (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
One	136.4	136.3	-0.1	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	-
Positive half cycle	135.4	135.1	-0.3	±2.0
Negative half cycle	135.4	135.1	-0.3	±2.0

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เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23029
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.1	0.1	± 1.1
135.0	135.1	0.1	± 1.1
134.0	134.1	0.1	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.1	0.1	± 1.1
114.0	114.1	0.1	± 1.1
109.0	109.1	0.1	± 1.1
104.0	104.1	0.1	± 1.1
99.0	99.1	0.1	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	28.9	-0.1	± 1.1
28.0	28.0	0.0	± 1.1
27.0	26.9	-0.1	± 1.1
26.0	26.0	0.0	± 1.1
25.0	24.9	-0.1	± 1.1

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เอกสารไม่ควบคุม

T. R. R.

Continuation of Calibration Certificate

Cert. No. : ACL23029
Job No. : VC66AC0023
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.6	0.1	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. R. R.

Cert. No. : ACL23118
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 01010778 / 194533 / 14656
ID No.: UAE.EFM.081/2565

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location :
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 05 APRIL 2023
Calibration Date : 10-11 APRIL 2023
Date of Issue : 18 APRIL 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul Pisutpaisan)

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other than in full, except with the prior written approval of the head of Calibration Laboratory.

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เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23118
Job No. : VC66AC0044
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter,
will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

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เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23118
Job No. : VC66AC0044
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0009-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL_BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL_BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL_BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
3.2 Thailand Institute of Scientific and Technological Research (TISTR).

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เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23118
Job No. : VC66AC0044
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.95)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
14.8

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	10.8
C - weight	17.2
Flat	23.1

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	-0.1	-0.1	-0.1	± 1.0
8000	0.7	0.8	0.8	± 5.0

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เอกสารไม่ควบคุม

Cert. No. : ACL23118
Job No. : VC66AC0044
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
63	0.0	0.0	0.0	±2.0
125	0.0	0.1	0.0	±1.5
250	0.0	0.0	0.0	±1.5
500	0.0	0.1	0.0	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.1	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	94.0	94.0	0.0	± 0.3

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เอกสารไม่ควบคุม

T. Petch

Cert. No. : ACL23118
Job No. : VC66AC0044
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8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.1	0.1	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
SEL	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.1	0.1	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.0	-0.4	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.1	0.1	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

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เอกสารไม่ควบคุม

T. Petch

Cert. No. : ACL23118
Job No. : VC66AC0044
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7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.0	0.0	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.0	0.0	± 1.1
69.0	69.0	0.0	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.0	0.0	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.1	0.1	± 1.1
29.0	29.2	0.2	± 1.1
28.0	28.2	0.2	± 1.1
27.0	27.3	0.3	± 1.1
26.0	26.4	0.4	± 1.1
25.0	25.6	0.6	± 1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch

Cert. No. : ACL23118
Job No. : VC66AC0044
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.6	89.6	0.0	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

T. Petch



Cert. No. : ACL23132
Pages : 1 of 8

Calibration Certificate

Equipment : SOUND LEVEL METER
Manufacturer : RION
Model : NL-42/ Microphone UC-52 / Preamplifier NH-24
Serial No.: 00709656 / 189028 / 01207
ID No.: UAE.EFM.021/2564

Condition As Found : GOOD

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT (UAE)
81 SOI UDOMSUK 41, SUKHUMVIT ROAD,
BANGCHAK SUB-DISTRICT,
PHRAKHANONG DISTRICT, BANGKOK 10260
THAILAND.

Location : +
Ambient Temperature : (23.0 ± 3) °C
Pressure : (101.3 ± 3) kPa
Relative Humidity : (50.0 ± 20) %

Received Date : 18 APRIL 2023
Calibration Date : 24-26 APRIL 2023
Date of Issue : 27 APRIL 2023

Calibrated by : Nathakorn Pisutpaisan

Approved by :

(Thanakul)

This certificate is issued in accordance with the requirements of ISO/IEC 17025 standard, may not be reproduced other than in full, except with the prior written approval of the head of Calibration Laboratory.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 2 of 8

Calibration Procedure : CP-AC-01

Calibration Method :

This equipment was calibrated by based on IEC-61672-3 (2013) Standard for sound level meter (SLM).
The SLM had tests to Acoustical and Electrical signal tests of frequency weighting with Anechoic chamber and Reference Standard Instruments.
For tests results of each items were made by observation of each Instruments display and also with SLM's display.

Condition of this result of calibration :

1. Reference Standard Instruments :

Instrument	Model	Serial No.	Cert. No.	Due Date
Waveform Generator	33210A	MY48017076	EF-0909-23	07-FEB-24
Waveform Generator	33511B	MY52302742	EF-0010-23	07-FEB-24
Digital Multimeter	33461A	MY53220104	EEL-BP 30/0266	13-FEB-24
Digital Multimeter	33461A	MY53220076	EEL-BP 29/0266	13-FEB-24
Digital Multimeter	34461A	MY60024273	EEL-BP 31/0266	14-FEB-24
Programmable Attenuator	MAT-1070	62100114	EF-0011-23	08-FEB-24
Condenser Microphone	4180	2977900	AA-1001-23	14-FEB-24
Measuring Amplifier	NA-42KAI	34560495	AA-3002-23	14-FEB-24

2. This result of calibration was found accurate as shown on date and place of calibration for this calibrated item only.

3. This certificate is traceable to the international system of unit maintained at :

- 3.1 National Institute of Metrology (Thailand).
- 3.2 Thailand Institute of Scientific and Technological Research (TISTR).

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 3 of 8

Summary of Measurement Result :

Parameter	Pass	Fail	Uncertainty (dB)	Maximum-permitted uncertainty of measurement (dB)
1. Absolute sensitivity	✓	-	0.2	N/A
2. Self-generated noise	✓	-	0.2	N/A
3. Acoustical signal tests of frequency weightings				
125 Hz	✓	-	0.3	0.6
1000 Hz	✓	-	0.3	0.6
8000 Hz	✓	-	0.3	0.7
4. Electrical signal tests of frequency weightings				
For 10 Hz to 4 kHz	✓	-	0.3	0.6
For > 4 kHz to 10 kHz	✓	-	0.3	0.7
For > 10 kHz to 20 kHz	-	-	-	1.0
5. Frequency and time weightings at 1 kHz	✓	-	0.2	0.2
6. Long - term stability	✓	-	0.1	0.1
7. Level linearity on the reference level range	✓	-	0.2	0.3
8. Level linearity including the level range control	✓	-	0.2	0.3
9. Tone burst response	✓	-	0.2	0.3
10. Peak C sound level	✓	-	0.2	0.35
11. Overload indication	✓	-	0.2	0.25
12. High level stability	✓	-	0.1	0.1

Note : Pass/Fail evaluation for each parameter, will be considered together from the acceptance limit and the Maximum-permitted uncertainty of measurement.

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 4 of 8

Result of calibration :

1. Absolute sensitivity

Reference Acoustic Signal (dB)	Measured Value (dB)	Deviation (dB)	Acceptance Limit (dB)
93.9 (93.98)	93.9	0.0	±0.3

2. Self-generated noise

2.1 Normal test

Measured Value (dB)
15.1

2.2 The microphone of the sound level meter was replaced by electrical signal input device.

Frequency Weighting	Measured value (dB)
A - weight	11.6
C - weight	17.6
Flat	23.3

3. Acoustical signal tests of frequency weightings

Meter free-field acoustic response at a level of 84 dB

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			
	Flat	C-weight	A-weight	Acceptance Limits
125	0.1	0.2	0.2	± 1.5
1000	0.0	0.0	0.0	± 1.0
8000	1.0	1.1	1.1	±5.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 5 of 8

4. Electrical signal tests of frequency weightings

Weighting network response with relative to 1 kHz.

Frequency (Hz)	Deviation from various frequency weighting response curve (dB)			Acceptance Limits
	Flat	C-weight	A-weight	
63	0.0	-0.1	-0.1	±2.0
125	0.0	0.0	0.0	±1.5
250	0.0	0.0	-0.1	±1.5
500	0.0	0.0	-0.1	±1.5
1000	0.0	0.0	0.0	±1.0
2000	0.0	0.0	0.0	±2.0
4000	0.0	0.0	0.0	±3.0
8000	0.0	0.1	0.1	±5.0

5. Frequency and time weightings at 1 kHz

5.1 Frequency weightings at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits
A - weight	94.0	94.0	0.0	± 0.2
C - weight	94.0	94.0	0.0	± 0.2
Flat	94.0	94.0	0.0	± 0.2

5.2 Time weighting at 1 kHz

Frequency Weighting	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits
Fast	94.0	94.0	0.0	± 0.1
Slow	94.0	94.0	0.0	± 0.1
Leq	94.0	94.0	0.0	± 0.1

6. Long - term stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits
A - weight	94.0	94.0	0.0	± 0.3

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 6 of 8

7. Level linearity on the reference level range

Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
137.0	137.0	0.0	± 1.1
136.0	136.0	0.0	± 1.1
135.0	135.0	0.0	± 1.1
134.0	134.0	0.0	± 1.1
133.0	133.0	0.0	± 1.1
132.0	132.0	0.0	± 1.1
131.0	131.0	0.0	± 1.1
129.0	129.0	0.0	± 1.1
124.0	124.0	0.0	± 1.1
119.0	119.0	0.0	± 1.1
114.0	114.0	0.0	± 1.1
109.0	109.0	0.0	± 1.1
104.0	104.0	0.0	± 1.1
99.0	99.0	0.0	± 1.1
94.0	94.0	0.0	± 1.1
89.0	89.0	0.0	± 1.1
84.0	84.1	0.1	± 1.1
79.0	79.0	0.0	± 1.1
74.0	74.1	0.1	± 1.1
69.0	69.1	0.1	± 1.1
64.0	64.0	0.0	± 1.1
59.0	59.1	0.1	± 1.1
54.0	54.0	0.0	± 1.1
49.0	49.0	0.0	± 1.1
44.0	44.0	0.0	± 1.1
39.0	39.0	0.0	± 1.1
34.0	34.0	0.0	± 1.1
30.0	30.0	0.0	± 1.1
29.0	29.0	0.0	± 1.1
28.0	28.0	0.0	± 1.1
27.0	27.0	0.0	± 1.1
26.0	25.9	-0.1	± 1.1
25.0	24.9	-0.1	± 1.1

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 7 of 8

8. Level linearity including the level range control

Range	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Auto	94.0	94.0	0.0	±1.1

9. Tone burst response

Time Weighting	Tone burst duration, Tb (ms)	Cycle	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Fast	0.25	1	108.0	107.9	-0.1	1.5 ; -5.0
	2	8	117.0	117.0	0.0	1.0 ; -2.5
	200	800	134.0	134.0	0.0	±1.0
Slow	2	8	108.0	108.0	0.0	1.5 ; -5.0
	200	800	127.6	127.6	0.0	±1.0
SEL	0.25	1	99.0	98.9	-0.1	1.5 ; -5.0
	2	8	108.0	108.0	0.0	1.0 ; -2.5
	200	800	128.0	128.0	0.0	±1.0

10. Peak C sound level

Number of cycle in test signal	Anticipated Value (dB)	Measured Value, L _{peak} (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±3.0
One	136.4	136.1	-0.3	±3.0

Number of cycle in test signal	Anticipated Value (dB)	Measured Value (dB)	Deviated Value (dB)	Acceptance Limits (dB)
Continuous	133.0	133.0	0.0	±2.0
Positive half cycle	135.4	135.2	-0.2	±2.0
Negative half cycle	135.4	135.2	-0.2	±2.0

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Continuation of Calibration Certificate

Cert. No. : ACL23132
Job No. : VC66AC0048
Pages : 8 of 8

11. Overload indication

Measured value (dB)		Deviated Value (dB)	Acceptance Limits (dB)
Positive one-half cycle	Negative one-half cycle		
89.5	89.7	0.2	±1.5

12. High level stability

Frequency Weighting	SLM Display at initial (dB)	SLM Display at final (dB)	Deviated Value (dB)	Acceptance Limits (dB)
A - weight	137.0	137.0	0.0	±0.3

The reported uncertainty is based on a standard uncertainty multiplied by coverage factor $k = 2$
or any value following calculation, providing a level of confidence of approximately 95 %

End of Calibration Certificate

QF-TS12-04-04-020664

เอกสารไม่ควบคุม

Certificate of Calibration

Customer

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

Certificate No : 23-LXM-313

Request No : Req-2023-2173

Page : 1/2

Unit Under Calibration Details

Instrument Name : Light Meter
Manufacturer : EXTECH
Model : 407026
Serial Number : A016905
Resolution : 1 lx
ID Number : UAE.EFM.018/2559

Range Calibration : 2000 , 20000 lx

Instrument Status : Used

Calibration Environment and Details

Temperature : $25^{\circ}\text{C} \pm 2^{\circ}\text{C}$
Humidity : $60\% \text{RH} \pm 20\% \text{RH}$
Received Date : 11 October 2023
Calibrated Date : 26 October 2023


Calibration Procedure : The measurement was done in accordance with CP-LXM-01

Reference Standard : Photometer and Illuminance Sensor, Serial No.: 30662/2, 30592/2, which was calibrated on 11 November 2022,
Certificate No.: TP-1027-22

Traceability : This Certificate is traceable to International System of Unit (SI) Unit through National Institute of
Metrology (Thailand)

Note

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

Approved By : 
Mr. Pacit
Calibration Engineer Supervisor
Issue Date : 13 May 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.00 Issue date 01/07/19

Calibration Note

UUC Adjustment : Zero adjustment before use

Certificate No : 23-LXM-313

Request No : Req-2023-2173


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Result of Calibration :

UUC Range (lx)	Standard (lx)	UUC Reading (lx)	Correction (lx)	Uncertainty (lx)
2000	70	0	0	0.0058
	50	50	0	2.2 % of Reading
	100	100	0	2.2 % of Reading
	200	199	1	2.2 % of Reading
	300	299	1	2.2 % of Reading
	400	402	-2	2.2 % of Reading
	600	604	-4	2.2 % of Reading
	800	803	-3	2.2 % of Reading
	1000	1003	-3	2.2 % of Reading
	1200	1206	-6	2.2 % of Reading
	1400	1405	-5	2.2 % of Reading
	1600	1609	-9	2.2 % of Reading
20000	1800	1811	-11	2.2 % of Reading
	2000	1991	9	2.2 % of Reading
	3000	2990	10	2.2 % of Reading
	4000	3970	30	2.2 % of Reading
	5000	4970	30	2.2 % of Reading

* Indicates not accredited

End of Certificate

Calibrated By : 
Mr. Noppadon

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-LXM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

Customer

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

Certificate No : 23-ASP-099

Request No : Req-2023-0902

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GILAir Plus
Serial Number : 20230410020
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : $23^{\circ}\text{C} \pm 3^{\circ}\text{C}$
Humidity : $55\% \text{RH} \pm 20\% \text{RH}$
Barometric Pressure : $1013 \text{ hPa} \pm 10 \text{ hPa}$
Received Date : 25 April 2023
Calibration Date : 10 May 2023

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	1903101003	Sensidyne	15 June 2023
Temperature meter	GT 11	12000977	Qnibora	27 February 2024
Pressure meter	Digi Mano	29508	PCAL	21 September 2023
Pressure meter	CPQ2400	41000KDU651882	TPA	7 November 2023

Traceability : This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :

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

Calibration By : 
Mr. Sitichok
Service Calibration Engineer
Approved By : 
Mr. Pacit
Calibration Engineer Supervisor
Issue Date : 10 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-099

Request No : Req-2023-0902

Result of Calibration : Lo

Temperature ($^{\circ}\text{C}$)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
30.70	100.94	0.022	0.020	-0.002	-0.002 l/min	0.003 l/min	5	0.0011
30.30	98.24	0.023	0.020	-0.003	-0.003 l/min	0.003 l/min	20	0.0011
30.30	95.86	0.023	0.020	-0.003	-0.003 l/min	0.003 l/min	40	0.0011
29.08	100.22	0.052	0.050	-0.002	-0.002 l/min	0.003 l/min	5	0.0028
30.00	101.10	0.055	0.050	-0.005	-0.003 l/min	0.003 l/min	20	0.0028
30.00	95.49	0.052	0.050	-0.002	-0.002 l/min	0.003 l/min	40	0.0028
29.30	100.21	0.104	0.100	-0.004	-3.8 %	5 (%)	5	0.0026
29.30	98.10	0.105	0.100	-0.005	-4.8 %	5 (%)	20	0.0026
29.30	95.44	0.104	0.100	-0.004	-3.8 %	5 (%)	40	0.0026
28.40	100.17	0.207	0.200	-0.007	-3.4 %	5 (%)	5	0.0036
28.40	98.14	0.208	0.200	-0.008	-3.8 %	5 (%)	20	0.0036
28.40	95.38	0.207	0.200	-0.007	-3.4 %	5 (%)	40	0.0036

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-099

Request No : Req-2023-0902

Result of Calibration : HI

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
26.30	101.00	0.522	0.500	-0.022	-4.2 %	5	5	0.0080
26.20	101.00	0.525	0.500	-0.025	-4.8 %	5	20	0.0080
26.60	101.00	0.528	0.500	-0.028	-5.3 %	5	40	0.0080
25.50	100.18	1.044	1.000	-0.044	-4.2 %	5	5	0.017
25.10	99.52	1.043	1.000	-0.043	-4.1 %	5	20	0.017
25.60	98.15	1.043	1.000	-0.043	-4.1 %	5	35	0.017
25.40	101.00	1.751	1.700	-0.051	-2.9 %	5	5	0.028
24.90	101.00	1.708	1.700	-0.008	-0.5 %	5	20	0.028
24.50	101.00	1.707	1.700	-0.007	-0.4 %	5	30	0.028
24.50	99.83	5.042	5.000	-0.042	-0.8 %	5	5	0.079
25.00	99.39	5.020	5.000	-0.020	-0.4 %	5	10	0.079

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

Note

* Indicates non accredited

** Reference Specifications ± 5% of set flow or ±3 cc/min whichever is higher

*** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.

เอกสารไม่ควบคุม

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-101

Request No : Req-2023-0902

Result of Calibration : Lo

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
30.20	99.84	0.020	0.020	0.000	0 l/min	0.003 l/min	5	0.0011
29.20	97.62	0.023	0.020	-0.003	-0.003 l/min	0.003 l/min	20	0.0011
29.20	95.36	0.023	0.020	-0.003	-0.003 l/min	0.003 l/min	40	0.0011
29.00	99.83	0.048	0.050	0.002	0.002 l/min	0.003 l/min	5	0.0028
29.50	100.60	0.049	0.050	0.001	0.001 l/min	0.003 l/min	20	0.0028
29.10	94.93	0.048	0.050	0.002	0.002 l/min	0.003 l/min	40	0.0028
28.60	99.74	0.100	0.100	0.000	0 %	5 (%)	5	0.0026
28.50	97.59	0.098	0.100	0.002	2 %	5 (%)	20	0.0026
28.40	95.07	0.098	0.100	0.002	2 %	5 (%)	40	0.0026
27.60	99.81	0.201	0.200	-0.001	-0.5 %	5 (%)	5	0.0036
27.40	97.74	0.200	0.200	0.000	0 %	5 (%)	20	0.0036
27.40	95.09	0.200	0.200	0.000	0 %	5 (%)	40	0.0036

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

Note

* Indicates non accredited

** Reference Specifications ± 5% of set flow or ±3 cc/min whichever is higher

*** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.

เอกสารไม่ควบคุม

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.

Address : R1 Soi Udomak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260

Certificate No : 23-ASP-101

Request No : Req-2023-0902

Unit Under Calibration Details

Measurement Item : Air Sampling Pump

Manufacturer : SENSIDYNE

Model : GilAir Plus

Serial Number : 20230410022

ID : -

Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C

Humidity : 55 %RH ± 20 %RH

Barometric Pressure : 1013 hPa ± 10 hPa

Received Date : 25 April 2023

Calibration Date : 10 May 2023

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023
Temperature meter	GT 11	12000077	Qrecho	27 February 2024
Pressure meter	Digi Mano	29508	PCAL	21 September 2023
Pressure meter	CPG2400	41008KDU651882	TPA	7 November 2023

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 1943.01

Note :

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

approximately 95 %.

Calibration By : 

Mr. Sitichok

Service Calibration Engineer

Approved By : 

Mr. Pait

Calibration Engineer Supervisor

Issue Date : 10 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.

เอกสารไม่ควบคุม

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-101

Request No : Req-2023-0902

Result of Calibration : HI

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
25.90	100.60	0.508	0.500	-0.008	-1.6 %	5	5	0.0080
25.90	100.60	0.522	0.500	-0.022	-4.2 %	5	20	0.0080
26.00	100.60	0.525	0.500	-0.025	-4.8 %	5	40	0.0080
25.60	99.71	0.999	1.000	0.001	0.1 %	5	5	0.016
25.00	97.71	0.998	1.000	0.002	0.2 %	5	20	0.017
25.20	95.60	0.996	1.000	0.004	0.4 %	5	35	0.017
24.50	100.50	1.708	1.700	-0.008	-0.5 %	5	5	0.028
24.70	100.50	1.707	1.700	-0.007	-0.4 %	5	20	0.027
25.00	100.50	1.709	1.700	-0.009	-0.5 %	5	30	0.028
24.70	99.30	5.033	5.000	-0.033	-0.7 %	5	5	0.079
24.18	98.92	5.033	5.000	-0.033	-0.7 %	5	10	0.079

Note STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature

Meas = Measurement Condition ref = Standard Condition

Note

* Indicates non accredited

** Reference Specifications ± 5% of set flow or ±3 cc/min whichever is higher

*** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuing organization.

เอกสารไม่ควบคุม

FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

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

Certificate No : 23-ASP-103
Request No : Req-2023-0902

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GIIAir Plus
Serial Number : 20230410024
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 25 April 2023
Calibration Date : 10 May 2023
Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023
Temperature meter	GT 11	12000977	Qnibreen	27 February 2024
Pressure meter	Digi Mano	29508	PCAL	21 September 2023
Pressure meter	CPG2400	41000KDU/651882	TPA	7 November 2023



Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 2943.01

Note :

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

Calibration By : 
Mr. Sittichok 
Service Calibration Engineer

Approved By : 
Mr. Pacit 
Calibration Engineer Supervisor
Issue Date : 10 May 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-103
Request No : Req-2023-0902

Result of Calibration : HI

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
26.70	101.10	0.503	0.500	-0.003	-0.6 %	5	5	0.0080
26.50	100.10	0.527	0.500	-0.027	-5.1 %	5	20	0.0080
26.30	100.10	0.524	0.500	-0.024	-4.6 %	5	40	0.0080
25.50	100.24	1.006	1.000	-0.006	-0.6 %	5	5	0.016
25.40	98.18	1.008	1.000	-0.008	-0.8 %	5	20	0.017
25.50	96.15	1.004	1.000	-0.004	-0.4 %	5	35	0.018
25.00	101.10	1.708	1.700	-0.008	-0.5 %	5	5	0.028
25.03	101.00	1.683	1.700	0.017	1 %	5	20	0.027
25.10	101.00	1.678	1.700	0.022	1.3 %	5	30	0.028
24.70	99.88	5.017	5.000	-0.017	-0.3 %	5	5	0.080
24.70	99.45	5.018	5.000	-0.018	-0.4 %	5	10	0.080

Note : STD : Standard UUC : Unit Under Calibration

- UUC Reference Condition : At 25 °C, 101.3 kPa, Air

- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
Meas = Measurement Condition ref = Standard Condition

Note

* Indicates non accredited

** Reference Specifications ± 5% of set flow or ±3 cc/min whichever is higher

*** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-103
Request No : Req-2023-0902

Result of Calibration : Lo

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
30.10	100.35	0.019	0.020	0.001	0.001 l/min	0.003 l/min	5	0.0011
30.00	98.00	0.020	0.020	0.000	0 l/min	0.003 l/min	20	0.0011
30.10	95.42	0.021	0.020	-0.001	-0.001 l/min	0.003 l/min	40	0.0011
29.70	100.24	0.050	0.050	0.000	0 l/min	0.003 l/min	5	0.0028
29.60	101.10	0.050	0.050	0.000	0 l/min	0.003 l/min	20	0.0028
29.50	95.36	0.050	0.050	0.000	0 l/min	0.003 l/min	40	0.0028
28.90	100.28	0.100	0.100	0.000	0 %	5 (%)	5	0.0026
28.80	98.19	0.098	0.100	0.002	2 %	5 (%)	20	0.0026
28.70	95.44	0.097	0.100	0.003	3.1 %	5 (%)	40	0.0026
28.80	100.25	0.203	0.200	-0.003	-1.5 %	5 (%)	5	0.0036
27.40	98.23	0.200	0.200	0.000	0 %	5 (%)	20	0.0036
28.00	95.48	0.200	0.200	0.000	0 %	5 (%)	40	0.0036

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

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

Certificate No : 23-ASP-143
Request No : Req-2022-2265

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : GIIAir 5
Serial Number : 20190601011
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 16 February 2023
Calibration Date : 6 June 2023

Calibration Procedure : In-house method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter



Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	15 June 2023
Air Flow Meter	Gilibrator 3 High flow	18501012012	Sensidyne	15 June 2023



Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 2943.01

Note :

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

Calibration By : 
Mr. Sittichok 
Service Calibration Engineer

Approved By : 
Mr. Pacit 
Calibration Engineer Supervisor
Issue Date : 6 June 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the issuer. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-143
Request No : Req-2022-2265

Result of Calibration : HI

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min), (%)	**Allowable Range (l/min), (%)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
24.90	99.24	1.030	1.000	-0.030	-2.9 %	5 (%)	5	0.0164
25.20	96.67	1.007	1.000	-0.007	-0.7 %	5 (%)	20	0.0160
25.10	92.99	0.997	1.000	0.003	0.3 %	5 (%)	40	0.0158
24.60	99.22	1.700	1.700	0.000	0 %	5 (%)	5	0.0271
24.80	96.70	1.692	1.700	0.008	0.5 %	5 (%)	20	0.0268
24.80	92.98	1.654	1.700	0.046	2.8 %	5 (%)	40	0.0265

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the lab. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-143
Request No : Req-2022-2265

Result of Calibration : HI

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min), (%)	**Allowable Range (l/min), (%)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
24.40	100.40	2.025	2.000	-0.025	-1.2 %	5	5	0.029
24.70	100.40	2.010	2.000	-0.010	-0.5 %	5	20	0.029
24.60	100.40	1.960	2.000	0.040	2 %	5	40	0.029
24.60	99.17	2.506	2.500	-0.006	-0.2 %	5	5	0.040
24.50	96.67	2.486	2.500	0.014	0.6 %	5	20	0.040
24.70	92.92	2.442	2.500	0.058	2.4 %	5	33	0.040
24.70	100.30	3.031	3.000	-0.031	-1 %	5	5	0.048
24.70	100.30	3.020	3.000	-0.020	-0.7 %	5	15	0.048
24.50	100.30	3.005	3.000	-0.005	-0.2 %	5	30	0.048
24.10	99.09	4.007	4.000	-0.007	-0.2 %	5	5	0.064
24.40	97.85	4.034	4.000	-0.034	-0.8 %	5	15	0.064
24.50	95.32	4.289	4.000	-0.289	-6.7 %	5	30	0.586
23.80	100.20	5.034	5.000	-0.034	-0.7 %	5	5	0.080
23.90	100.20	5.078	5.000	-0.078	-1.5 %	5	10	0.080

Note
STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At 25 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{ref}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
Meas = Measurement Condition ref = Standard Condition

Note
* Indicates non accredited
** Reference Specifications ± 5% of set flow or ±3 cc/min whichever is higher
*** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the lab. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

Certificate No : 23-ASP-180
Request No : Req-2023-1639

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

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : G4 Air Plus
Serial Number : 20250610198
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : (23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 3 August 2023
Calibration Date : 22 August 2023
Calibration Procedure : In-house method CP-ASP-01 based on ISO 11137 by Comparison With Standard Air Flow Meter

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilbreath 3 Standard flow	19031011003	Sensidyne	31 July 2024
Air Flow Meter	Gilbreath 3 High flow	10301012012	Sensidyne	31 July 2024


Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943-01

Note :

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

Calibration By : 
Mr. Nopaporn
Service Calibration Engineer

Approved By : 
Mr. Pait
Calibration Engineer Supervisor
Issue Date : 22 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the lab. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-180
Request No : Req-2023-1639

Result of Calibration : Low

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min), (%)	**Allowable Range (l/min), (%)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
23.30	100.50	0.019	0.020	-0.001	-0.003 l/min	0.003 l/min	5	0.0009
23.30	100.50	0.021	0.020	-0.001	-0.003 l/min	0.003 l/min	20	0.0009
23.30	100.50	0.022	0.020	-0.002	-0.002 l/min	0.003 l/min	40	0.0009
23.30	100.60	0.030	0.030	0.000	0 l/min	0.003 l/min	5	0.0012
23.30	100.50	0.030	0.030	0.000	0 l/min	0.003 l/min	20	0.0012
23.30	100.50	0.049	0.050	0.001	0.001 l/min	0.003 l/min	40	0.0012
23.10	100.50	0.098	0.100	0.002	2 %	5 (%)	5	0.0018
23.10	100.50	0.099	0.100	0.001	1 %	5 (%)	20	0.0018
23.30	100.60	0.099	0.100	0.001	1 %	5 (%)	40	0.0018
23.30	100.50	0.203	0.200	-0.003	-1.5 %	5 (%)	5	0.0033
23.10	100.50	0.201	0.200	-0.001	-0.5 %	5 (%)	20	0.0033
23.00	100.50	0.197	0.200	0.003	1.5 %	5 (%)	40	0.0033
22.90	100.30	0.439	0.440	0.001	0.2 %	5 (%)	5	0.0070
22.90	100.30	0.437	0.440	0.003	0.7 %	5 (%)	20	0.0070
22.90	100.30	0.436	0.440	0.004	0.9 %	5 (%)	40	0.0070

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the lab. **เอกสารไม่ควบคุม**
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-188
Request No : Req-2023-1639

Result of Calibration : High

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
22.90	100.50	0.449	0.459	0.001	0.2 %	5	5	0.007
22.90	100.50	0.453	0.459	-0.005	-0.7 %	5	20	0.007
22.90	100.50	0.452	0.459	-0.002	-0.4 %	5	40	0.007
22.90	100.50	1.002	1.000	-0.002	-0.2 %	5	5	0.017
22.90	100.50	0.999	1.000	0.001	0.1 %	5	20	0.017
22.90	100.50	0.996	1.000	0.014	1.4 %	5	35	0.016
22.90	100.50	2.010	2.000	-0.010	-0.5 %	5	5	0.032
22.90	100.50	1.997	2.000	0.003	0.2 %	5	15	0.032
22.80	100.50	3.983	2.000	0.017	0.9 %	5	30	0.032
22.80	100.50	4.011	4.000	-0.011	-0.3 %	5	5	0.064
22.80	100.50	4.015	4.000	-0.015	-0.4 %	5	10	0.064
22.80	100.50	3.999	4.000	0.001	0 %	5	20	0.064
23.00	100.50	5.034	5.000	-0.034	-0.7 %	5	5	0.095
23.00	100.50	5.002	5.000	-0.002	0 %	5	10	0.079

Note : STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At 25 °C, 101.3 kPa Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{meas} = Q_{ref} \times \frac{P_{ref}}{P_{meas}} \times \frac{T_{meas}}{T_{ref}}$$

where : Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
meas = Measurement Condition ref = Standard Condition

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.00 Issue date 6/10/23

Certificate No : 23-ASP-188
Request No : Req-2023-1639

* Constant Pressure

STD Flow Reading (LPM)	Flow Allowable Range (LPM)	UUC Back Pressure Reading (inH ₂ O)	STD Back Pressure Reading (inH ₂ O)	Back Pressure Allowable Range (inH ₂ O)	Uncertainty BP (inH ₂ O)
Low					
0.021	0.015 - 0.025	17.9	18	16-20	0.22
0.051	0.045 - 0.055	17.9	18	16-20	0.22
0.099	0.090 - 0.110	17.9	18	16-20	0.22
0.206	0.180 - 0.230	17.9	18	16-20	0.22
0.441	0.410 - 0.470	18.0	19	16-20	0.22
High					
0.490	0.420 - 0.480	17.9	17.8	16-20	0.22
1.005	0.900 - 1.100	17.9	17.8	16-20	0.22
2.010	1.800 - 2.200	17.9	17.6	16-20	0.22
4.034	3.600 - 4.400	17.9	17	16-20	0.22

Note :
* Indicates non accredited
** Reference Specifications : ± 3% of set flow or ± 3 % cmh whichever is higher
*** Specified in ISO 13137, Back Pressure control : 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.00 Issue date 6/10/23

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO.,LTD.
Address : 81 Soi Udomsak-41, Sakharuwi Road, Bangchak, Pratong, Bangkok 10500
Certificate No : 23-ASP-191
Request No : Req-2023-1639

Unit Under Calibration Details

Measurement Item : Air Sampling Pump
Manufacturer : SENSIDYNE
Model : G4Air Plus
Serial Number : 20230610203
ID : -
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 kPa ± 10 kPa
Received Date : 3 August 2023
Calibration Date : 23 August 2023

Calibration Procedure : Irrelevant method CP-ASP-01 based on ISO 13137 by Comparison With Standard Air Flow Meter

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	11 July 2024
Air Flow Meter	Gilibrator 3 High flow	18101012012	Sensidyne	11 July 2024

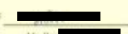
Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3940-01

Note :

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

Calibration By : 
Mr. Nopphol
Service Calibration Engineer

Approved By : 
Mr. P
Calibration Engineer Supervisor
Issue Date : 23 August 2023

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.00 Issue date 6/10/23

Certificate No : 23-ASP-191
Request No : Req-2023-1639

Result of Calibration : Low

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
22.50	100.60	0.019	0.020	0.001	0.001 l/min	0.003 l/min	5	0.0009
22.50	100.60	0.019	0.020	0.001	0.001 l/min	0.003 l/min	20	0.0009
22.40	100.60	0.018	0.020	0.002	0.002 l/min	0.003 l/min	40	0.0009
22.30	100.60	0.051	0.050	-0.001	-0.001 l/min	0.003 l/min	5	0.0012
22.50	100.60	0.052	0.050	-0.002	-0.002 l/min	0.003 l/min	20	0.0012
21.90	100.60	0.049	0.050	0.001	0.001 l/min	0.003 l/min	40	0.0012
22.60	100.60	0.101	0.100	-0.003	-3.0 %	5 %	5	0.0019
22.50	100.60	0.102	0.100	-0.002	-2 %	5 %	20	0.0019
22.50	100.60	0.101	0.100	-0.001	-1 %	5 %	40	0.0018
22.60	100.60	0.202	0.200	-0.002	-1 %	5 %	5	0.0033
22.60	100.60	0.202	0.200	-0.002	-1 %	5 %	20	0.0033
22.50	100.60	0.200	0.200	0.000	0 %	5 %	40	0.0033
22.60	100.60	0.440	0.440	0.000	0 %	5 %	5	0.0070
22.50	100.60	0.441	0.440	-0.001	-0.2 %	5 %	20	0.0070
22.60	100.60	0.440	0.440	0.000	0 %	5 %	40	0.0070

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the body.
เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.00 Issue date 6/10/23

Certificate No : 23-ASP-191
Request No : Req-2023-1639

Result of Calibration : High

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Error (l/min, %)	**Allowable Range (l/min, %)	***Back Pressure (inH ₂ O)	Uncertainty (l/min)
22.60	100.60	0.450	0.450	0.000	0%	5	5	0.007
22.60	100.60	0.450	0.450	0.000	0%	5	30	0.007
22.60	100.60	0.448	0.450	0.002	0.4%	5	40	0.007
22.50	100.60	1.002	1.000	-0.002	-0.2%	5	5	0.016
22.50	100.60	0.992	1.000	0.008	0.8%	5	20	0.016
22.50	100.60	0.994	1.000	0.006	0.6%	5	15	0.017
22.40	100.60	2.000	2.000	-0.005	-0.1%	5	5	0.032
22.40	100.60	1.996	2.000	0.004	0.2%	5	15	0.033
22.40	100.60	1.998	2.000	0.002	0.1%	5	30	0.032
22.30	100.60	3.996	4.000	0.004	0.1%	5	5	0.064
22.30	100.60	3.994	4.000	0.006	0.2%	5	10	0.064
22.30	100.60	3.996	4.000	0.004	0.1%	5	20	0.064
22.60	100.60	5.000	5.000	0.000	0%	5	5	0.080
22.50	100.60	5.007	5.000	-0.007	-0.1%	5	10	0.079

Note : STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At 25 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where : Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
Meas = Measurement Condition ref = Standard Condition

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.
เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate No : 23-ASP-191
Request No : Req-2023-1639

* Constant Pressure

STD Flow Reading (LPM)	Flow Allowable Range (LPM)	UUC Back Pressure Reading (inH ₂ O)	STD Back Pressure Reading (inH ₂ O)	Back Pressure Allowable Range (inH ₂ O)	Uncertainty BP (inH ₂ O)
Low					
0.021	0.015-0.025	17.9	17.8	16-20	0.22
0.051	0.045-0.055	17.9	17.9	16-20	0.22
0.089	0.080-0.110	17.9	17.6	16-20	0.22
0.206	0.180-0.220	17.9	18	16-20	0.22
0.441	0.410-0.470	18.0	18	16-20	0.22
High					
0.450	0.420-0.480	17.9	17.8	16-20	0.22
1.005	0.900-1.100	17.9	17.8	16-20	0.22
2.010	1.800-2.200	17.9	17.8	16-20	0.22
4.004	3.600-4.400	17.9	18.0	16-20	0.22

Note :
* Indicates non accredited
** Reference Specifications : ± 5% of set flow or ±3 cc/min whichever is higher
*** Specified in ISO 13137, Back Pressure control ± 1 inH₂O

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.
เอกสารไม่ควบคุม
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

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

Certificate No : 24-AFM-010 Rev.1
Request No : Req-2023-2235

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : TSI
Model : 4146 Sensor Model : -
Serial Number : 41461922008 Sensor Serial Number : -
ID : UAE-EFM-224-2562
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 18 October 2023
Calibration Date : 23 January 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Air Flow Meter	Gilibrator 3 Low flow	18501010006	Sensidyne	12 July 2024
Air Flow Meter	Gilibrator 3 Standard flow	19031011003	Sensidyne	12 July 2024
Temperature meter	GT 11	08000057	Qcbsom	27 February 2024
Pressure meter	CPG2400	41000KDC/651882	TPA	9 November 2024

Traceability :

This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor k = 2, providing a level of confidence approximately 95 %
This Certificate was issued to replace in Calibration Certificate No. 24-AFM-010

Calibration By : 
Mr. Noppadon
Service Calibration Engineer

Approved By : 
Mr. Paich
Calibration Engineer Supervisor

Issue Date : 24 April 2024

เอกสารไม่ควบคุม

Certificate No : 24-AFM-010 Rev.1
Request No : Req-2023-2235

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.40	101.19	0.020	0.020	0.000	0.0013
24.30	101.15	0.050	0.050	0.000	0.0033
24.40	101.13	0.099	0.100	0.001	0.0028
24.50	100.95	0.200	0.202	0.002	0.0056
24.60	100.91	0.501	0.500	-0.001	0.0074
26.60	100.96	0.994	1.000	0.006	0.035
24.50	100.90	1.691	1.701	0.010	0.025
24.60	100.82	1.997	2.011	0.014	0.029
26.60	101.20	2.993	3.020	0.027	0.042
24.50	101.20	4.019	4.000	-0.019	0.056
24.60	101.20	5.024	5.006	-0.018	0.070

Note : STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At 23.1 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where : Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited
End of Certificate

เอกสารไม่ควบคุม
The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovator Instrument Co., Ltd.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

Certificate of Calibration

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

Unit Under Calibration Details
Measurement Item : Air Flow Meter
Manufacturer : TSI
Model : 4146
Serial Number : 4146170009
ID : UAE.EFM.103/2561
Location of Calibration : LAB 4 AIR VELOCITY METER

Calibration Environment and Details
Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 7 February 2024
Calibration Date : 22 March 2024
Calibration Procedure : In-house method CP-AFM-01 by Comparison technique with Standard Primary Flow Calibrator

Reference Standard
Model Serial Number Traceable Due Calibration
Air Flow Meter Gilibrator 3 Low flow 18501010006 Sensidyne 12 July 2024
Air Flow Meter Gilibrator 3 Standard flow 19031011003 Sensidyne 12 July 2024
Temperature meter GT 11 08000057 Qreborn 1 March 2025
Pressure meter CPG2400 41000KDC/651882 TPA 9 November 2024

Traceability :
This Certificate is traceable to SI Unit through Sensidyne A2LA Accreditation No. 3943.01

Note :
The reported uncertainty is based on standard uncertainty multiplied by the Coverage Factor $k = 2$, providing a level of confidence approximately 95 %.
This Certificate was issued to replace to Calibration Certificate No. 24-AFM-057

Calibration By : 
Mr. Noppadon 
Service Calibration Engineer

Approved By : 
Mr. Puch 
Calibration Engineer Supervisor

Issue Date : 24 April 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

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Certificate No : 24-AFM-057 Rev.1

Request No : Req-2024-0325

Result of Calibration :

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)
24.18	100.69	0.020	0.020	0.000	0.0013
24.00	100.70	0.049	0.050	0.001	0.0033
23.90	100.73	0.099	0.101	0.002	0.0028
24.00	100.77	0.200	0.200	0.000	0.0056
24.10	100.93	0.563	0.500	-0.063	0.0072
26.60	100.73	0.993	1.000	0.007	0.015
24.70	100.72	1.693	1.700	0.007	0.024
24.80	100.68	1.987	2.000	0.013	0.028
25.20	100.71	2.974	3.000	0.026	0.042
25.50	100.69	3.961	4.000	0.039	0.056
25.90	100.79	4.963	5.000	0.037	0.070

Note
STD : Standard UUC : Unit Under Calibration
- UUC Reference Condition : At 21.1 °C, 101.3 kPa, Air
- Flow Rate was corrected for non-standard operating condition by using equation :

$$Q_{\text{meas}} = Q_{\text{ref}} \times \frac{P_{\text{ref}}}{P_{\text{meas}}} \times \frac{T_{\text{meas}}}{T_{\text{ref}}}$$

where : Q = Flow Rate P = Absolute Pressure T = Absolute Temperature
Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

End of Certificate

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the Innovative Instrument Co., Ltd.
FM-708-AFM-01 Rev.00 Issue date 01/07/19

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TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG, BANGKOK 10250
TEL.: 0-2717-3000-24 FAX: 0-2719-9484



Certificate of Calibration

Certificate No. : 24P1145
Page : 1 of 2

Equipment : Aneroid Barometer
Manufacturer : Barigo
Model : 111MS
Serial No. : -
ID No. : UAE.EMA2.067/2552
Condition As-Received : Used Item
Received Date : 03 April 2024
Calibration Date : 09 April 2024
Reference : 2404-0119WSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1007 mbar
Submitted by : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak,
Phrakhanong, Bangkok 10260
Procedure used : The calibration was conducted by direct comparison method against Pressure Measuring Instruments Standard according to calibration procedure CP-P10, using " DKD-R 6-1 ; Calibration of Pressure Gauges " as a guidelines.

Condition of this result of calibration

1.Reference standards instruments :

Instrument	Model	Serial No.	Certificate No.	Due Date
1) Standard Barometer	DPI142	1422505046	MP-0094-23	03 May 2024

2.This instrument was installed in vertical orientation and center of the dial was used as the reference level.

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

4.Scale and conversion factor is 1 kPa = 7.50062 mmHg

5.This result of calibration instrument was in absolute pressure.

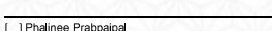
6.This instrument was used clean air as pressure media.

7.The certificate is valid only to the item calibrated on date and place of calibration.

8.This Certification is traceable to the International System of Unit maintained through-

-National Institute of Metrology Thailand (NIMT)

Calibrated by : Suksan Khankaew
Issue Date : 10 April 2024

Approved Signatory : 
[] Phalinee Prapapal
[] Sura Suwannasri
[✓] Attapol Panurach

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Result of calibration:- Without adjustment
Function:- Absolute Pressure Measurement

Range : 720 mmHg to 780 mmHg
Scale Interval : 1 mmHg (The Fifth Estimate)

Applied Pressure (mmHg)	717.86	729.00	739.73	750.27	761.74	773.61	786.17
UUC* Indication (mmHg)	720.0	730.0	740.0	750.0	760.0	770.0	780.0
Error (mmHg)	2.14	1.00	0.27	-0.27	-1.74	-3.61	-6.17

Applied Pressure (mmHg)	786.17	773.15	760.92	749.39	738.50	727.65	717.77
UUC* Indication (mmHg)	780.0	770.0	760.0	750.0	740.0	730.0	720.0
Error (mmHg)	-6.17	-3.15	-0.92	0.61	1.50	2.35	2.23

The uncertainty of measurement was ± 0.24 mmHg
* UUC = Unit Under Calibration

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

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Cert.No.: 24P1145
Page: 2 of 2

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Calibration Certificate

Certificate No.: 2402284-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhong, Bangkok 10260

Page 1 of 3

Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: MS6035/01
Serial No.: 8007010311
ID No.: UAE.TOX.008/2553
Order No.: 2402284
Operation No.: 2402284-001
Date of Receipt: 2 April 2024
Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist
Approved by (Mr.Pheraphat)
Manager, Division of Calibration Laboratory
Responsible for the Technical Management Team
Date of Issue: 9 April 2024

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.: 2402284-001-01
Equipment: Electronic Balance
Model: MS6035/01
Serial No.: 8007010311
Capacity: 620
Manufacturer: METTLER TOLEDO
Resolution: 0.001
ID No.: UAE.TOX.008/2553

Page 2 of 3

Date of Calibration: 2 April 2024
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 48 ± 2.5 %
Place of Calibration: Laboratory, UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Condition of Equipment: Good Condition
Condition of This Results of Calibration:
1. Calibration Method: NIST 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 8505567572 TCS M23040525 8 April 2024
Standard Weight Class E2 500g 8505567696 TCS M23040545 8 April 2024
Instrument Model Serial No. Calibrated By Certificate No. Due Date
Thermo-Hygro Meter 608-H1 NTLBTH 017/23 Quality Reborn QR24-0344 9 February 2025
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:

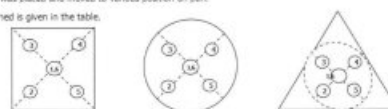
1. Repeatability of Reading:

Nominal Value (g)	Standard Deviation of Reading (g)
300	0.00000
600	0.00048

2. Off-Center Error:

A mass of 200 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)
200.000	199.997	199.999	199.999	199.998	200.000	0.003

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

Calibration Report

Certificate No.: 2402284-001-01
Equipment: Electronic Balance
Model: MS6035/01
Serial No.: 8007010311
Capacity: 620
Manufacturer: METTLER TOLEDO
Resolution: 0.001
ID No.: UAE.TOX.008/2553

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 600 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
Unloaded	0.0000	0.000	0.000	0.00082	2.00
0.1	0.1000	0.100	0.000	0.00082	2.00
0.5	0.5000	0.500	0.000	0.00082	2.00
1	1.0000	1.000	0.000	0.00082	2.00
2	2.0000	2.000	0.000	0.00082	2.00
5	5.0000	5.000	0.000	0.00082	2.00
10	10.0000	10.000	0.000	0.00082	2.00
20	20.0000	20.000	0.000	0.00082	2.00
50	50.0000	50.000	0.000	0.00082	2.00
100	100.0000	100.000	0.000	0.00082	2.00
150	150.0000	150.000	0.000	0.00082	2.00
200	200.0000	200.000	0.000	0.00082	2.00
300	300.0000	299.999	0.001	0.00096	2.00
400	400.0000	399.998	0.002	0.00100	2.00
500	500.0000	499.997	0.003	0.00111	2.00
600	600.0000	599.996	0.004	0.0012	2.00

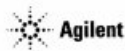
The reported uncertainty of measurement was based on a standard uncertainty multiplied by a coverage factor k = 2, providing a level of confidence of approximately 95 %.

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

Agilent CrossLab Start Up Services Agilent 7890 Gas Chromatograph Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical instruments to assure reliable operation and the accuracy of your results.

Delivered by highly trained and certified service engineers using genuine Agilent parts and supplies, Agilent Preventive Maintenance provides everything you need to reduce unplanned downtime and keep your systems operating at their peak. This checklist will be completed at the end of the service and provided to you as a record of the preventive maintenance activities.



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Introduction

Customer Information

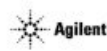
- Customers should provide all necessary operating supplies upon request of the engineer.
- A customer representative should be available to the engineer while performing the preventive maintenance procedures.
- Any parts, not included in the Parts Lists section of this document, are not part of the recommended Preventive Maintenance service, nor are they included in the price of this service.
- If a system requires the use of extra or special procedures and/or parts for the maintenance service, then these must be ordered separately and charged as a repair, which may incur additional costs.

Important Customer Web Links

- For more information about **Agilent Technologies services**, please visit our website using the following URL: <http://www.agilent.com/en-us/products/crosslab-instrument-services/service-repair>
- The **Agilent Community** is an excellent place to get answers, collaborate with others about applications and Agilent products, and find in-depth documents and videos relevant to Agilent technologies. Visit <https://community.agilent.com/welcome>.
- To access **Agilent University**, visit <http://www.agilent.com/crosslab/university/> to learn about training options, which include online, classroom and onsite delivery. A training specialist can work directly with you to help determine your best options.
- A useful **Agilent Resource Center** web page is available, which includes short videos on maintenance, quick lists of consumables for new instruments, and other valuable information. Check out the Resource Page here: <https://www.agilent.com/en-us/agilentresources>.
- Need technical support, FAQs, supplies? – visit our **Support Home page** <http://www.agilent.com/search/support>.
- Videos** about specific preparation requirements for your instrument can be found by searching the **Agilent YouTube** channel at <https://www.youtube.com/user/agilent>.
- 7890B Manuals** are also available on Agilent.com:
 - Safety** https://www.agilent.com/cs/library/usermanuals/public/7890B_Safety.pdf
 - Installation and First Startup** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Installation.pdf
 - Operation Manual** https://www.agilent.com/cs/library/usermanuals/Public/7890B_Operation.pdf
 - Maintaining Your GC** https://www.agilent.com/cs/library/usermanuals/public/G3430-90052%207890B_Maintaining%20Guide.pdf

Revision: 2.00, Issued: December 30, 2020
Agile Document Number: D0007063
DE number: 44166.759722222
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Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Only select those pages that relate to the system or module being serviced.
- Complete empty fields with the relevant information.
- Complete the relevant checkboxes in the checklist using either a "X" or tick mark "✓".
- Check "Section not applicable" check boxes to indicate services/tasks not delivered, as appropriate.
- Complete the Preventive Maintenance service in the order of the tasks listed.
- Complete the Service Review section together with the customer.
- Complete the fields for page numbers at the foot of each selected page.
- Complete the total number of pages field in the Service Completion section.
- Ask the customer to sign the Service Completion section including the customer's and your signature.

Additional Instruction Notes

- Check for any active service notes for this unit. If there are any applicable "Safety" or "Modification Recommended" Service notes, plan to implement the changes on this unit before doing any qualification service.
- Do not implement firmware updates, unless you get approval from the customer and are sure that they are compatible with the instrument control software.



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System Information

- ☒ Check this box if an instrument configuration report is attached instead of completing the table below.

Instrument System Name and ID	UAE_TOX.021/2556_CN13113001
Instrument System Site and Location	Room 404

List System Component Product Numbers	List the Serial Numbers of each Component
1. G3440B	CN13113001
2. G4513A	CN22285355
3. G4514A	CN13200169
4.	
5.	
6.	
7.	
8.	
9.	
10.	

Preparation

- ☒ Discuss any specific issues with the customer before starting.
- ☒ Review the instrument logbook for recorded problems and comments.
- ☒ Save instrument control settings before starting the procedure.
- ☒ Perform a general inspection of the system for cleanliness.
- ☒ Check for proper installation of parts, assemblies, sensors etc.
- ☒ Check system for required installation of components, settings as defined by current Service Notes.
- ☒ Check for required firmware updates and verify with customers if they would like them installed.
- ☒ Before starting the following procedures, record the Detector Signal Output(s) in the results table. If the GC is turned OFF or in a service mode, comparing the detector outputs before and after the service is not possible.



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Preventive Maintenance Procedure

Clean and inspect GC

- ☒ Unplug power cord from the power source.
- ☒ Open GC covers and vacuum/remove any dust/debris. Pay particular attention to cooling fans.
- ☒ Inspect internal connectors for proper contact and placement.
- ☒ Reconnect Power to the GC. Power the GC on and verify the power on self-test passed.
- ☒ Verify oven motor spins freely and turns on with the oven door closed; off when the door is opened.
- ☒ Verify operation of all other fans - the Inlet and EPC cooling fans.
- ☒ Verify oven intake/outlet flap assembly is operating smoothly while heating and cooling the oven

Inlet and detector consumable replacement

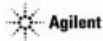
- ☒ For the inlets installed, perform inlet maintenance as defined in the 7890 manual - "Maintaining Your GC" - for the Inlet(s) installed.
- ☒ Replace the split vent trap cartridge filter on units with these inlets: Split/Splitless Capillary (SSL), Multi-Mode Inlet (MMI), Programmed Temperature Vaporizer (PTV), Volatiles Interface (VI).
- ☒ If the inlet system is used in Split Mode with viscous samples, inspect and clean the split vent tube on the inlet and flush or replace the tubing between the inlet and the split vent trap.
- ☒ If the GC includes a Flame Ionization Detector (FID), replace the jet. If the ignitor shows any buildup of sample or corrosion, replace the ignitor. Examine the FID collector and castle assemblies for contamination - clean as necessary.

Zero Sensors and Leak test

- ☒ Zero all pressure sensors per the procedure in the 7890 "Advanced User Guide".
- ☒ Perform inlet pressure decay test(s) as defined in the 7890 "Troubleshooting Manual". If the PM is done in preparation for an Operational Qualification, then the pressure decay test defined within that protocol can be used for the PM.
- ☒ Record if test passed or failed in the results table.

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ALS Maintenance

- ☐ Section NOT applicable
- ☒ Check all cabling and configuration settings between GC, tray, and injectors.
- ☒ Vacuum or remove any dust, especially around fans.
- ☒ Check operation of all fans.
- ☒ Check syringe for smooth plunger operation.
- ☒ Check for smooth operation of the needle support - clean if necessary

Restore Instrument

- ☒ Restore the normal operating conditions or customer method using the Browser interface or Data System.
- ☒ Purge the system with carrier flow for 15 minutes
- ☒ Bake out the system, then restore the normal operating conditions
- ☒ After equilibration, check and record the post PM detector signal output values. Results should be similar or lower than the detector outputs recorded prior to PM.
- ☒ Perform a chemical checkout. If this is a routine PM, inject the customer's sample using the ALS if applicable. This will act as a final checkout of both the ALS and the GC.

Note: If the PM Service is performed prior to a qualification service, then use the qualification procedure as a guide for final instrument set up and checkout.

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Signature Page

Service Review

- ☒ Attach available reports/printouts of all tests to this documentation.
- ☒ Record the Preventive Maintenance service activity in the customer's records/logbook.
- ☒ Update/reset instrument maintenance counters as appropriate.
- ☒ Affix the PM sticker to the system or instrument logbook based on the customer's request.
- ☒ Complete the Service Engineer Comments section if there are additional comments.
- ☒ Review with the customer this service, parts replaced, and test results obtained.
- ☒ If the instrument firmware was updated, record the details of the change in the Service Engineer's Comments box or if necessary, in the customer's IQ records.
- ☐ Supply the customer with a copy of the Smart Alerts flyer.
- ☐ Describe Smart Alerts to the customer.
- ☐ Install Smart Alerts if requested.

7890 GC Test Results Table

Detector Signal Outputs	Before PM Service	After PM Service
Front detector output		24.2
Back detector output		NA.
AUX detector output		NA.
Pressure decay test	Expected test result	Actual test result
Front inlet pressure decay test	Pass	Pass
Back inlet pressure decay test	Pass	NA.

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7890 Parts List Table

The following kits are recommended for capillary and purged packed inlets. If this is a general PM and the customer has a preferred set of consumables, you may use the customer's consumables.

Part description	Part number	Product or model# where used	Quantity consumed
SSL Capillary Inlet PM kit, Splitless	5188-6497	7890A/B	2
SSL Capillary Inlet PM kit, split	5188-6496	7890A/B	
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
SSL Capillary Ultra Inert Inlet Low Pressure Drop Split Liner - with Glass Wool	5190-2295	7890A/B	
PP Inlet PM kit	5188-6498	7890A/B	
Split vent trap PM kit, single cartridge (for MMI, PTV & VI)	5188-6495	7890A/B	
MMI Cleaning Kit	G3510-60820	7890A/B	
PTV Septumless Head Rebuild Kit	5182-9747	7890A/B	
PTV Septumless Head Teflon Guide	5182-9748	7890A/B	
Ignitor (glow plug) assembly with O-ring	19231-60680	7890A/B	
FID Collector Rebuild/Cleaning Kit	G1531-67000	7890A/B	
Standard .011-inch FID Jet for capillary FID base	G1531-80560	7890A/B	1
High Temperature .018-inch FID Jet for capillary FID base	G1531-80620	7890A/B	
Standard .018-inch FID Jet for packed column with packed FID base	18710-20119	7890A/B	
Standard .011-inch FID Jet for capillary column with packed/adaptable FID base	19244-80560	7890A/B	
High Temperature .018-inch FID Jet for capillary column with packed/adaptable FID base	19244-80620	7890A/B	
NPD Jet, universal fit, .011-inch ID	G1534-80580	7890A/B	
NPD Jet, universal fit, .011-inch ID Extended tip	G1534-80590	7890A/B	
SSL Capillary Ultra Inert Inlet Gold Seal with Washer	5190-6144	7890A/B	
SSL Capillary Ultra Inert Inlet Splitless Liner - Single taper with Glass Wool	5190-2293	7890A/B	
**FID Collector Replacement Kit, if needed	G1531-67001	7890A/B	

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Service Engineer Comments

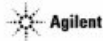
If there are any specific points you wish to note as part of performing the service or other items of interest for the customer, please write include them in this box.

Service Completion

Service request number 6006748423 Date service completed 17 April 2024
Agilent signature Phuwanoi Customer signature _____
Total number of pages in this document 9

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Calibration Certificate

Certificate No.: 2402420-001-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 Soi Udomsuk 41, Sukhumvit Road,
Bangchack, Prakhonong, Bangkok 10260

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Equipment: Electronic Balance
Manufacturer: METTLER TOLEDO
Model: AB204-S/FACT
Serial No.: B108115858
ID No.: UAE.AIR.016/2555
Order No.: 2402420
Operation No.: 2402420-001
Date of Receipt: 19 April 2024
Date of Calibration: 19 April 2024

Calibrated by Mr. Pheraphat Tuanjit
Scientist
Approved by Phuwanoi
(Miss Preeyaporn Jaengkarnkit)
Vice President, Department of Laboratory Services
Responsible for the Technical Management Team
Date of Issue: 23 April 2024

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.: 2402420-001-01
Equipment: Electronic Balance
Model: AB204-S/FACT
Serial No.: B108115858
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.0001 g
ID No.: UAE.AIR.016/2555

Page 2 of 3

Date of Calibration: 19 April 2024
Environment Condition: Ambient Temperature: 22.1 ± 0.6 °C Relative Humidity: 49 ± 1.9 %
Place of Calibration: Room 206 Balance Room 2, 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	1-500mg	15880	TCS	M23111815	28 November 2024
Standard Weight Class E2	1-500g	15882	TCS	M23111825	28 November 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	658-H1	NFI.BTH 019/23	Quality Reborn	QR24-0492	4 March 2025

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	0.009057
200	0.009079

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)
99.9999	99.9997	99.9996	99.9998	100.0000	99.9998	0.00023

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

REPORT OF CALIBRATION

Certificate No. : SP24-018

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.0000	0.0000	0.0050	2.00
	0.7469	0.7435	0.0034	0.0057	2.00
257	0.0000	0.0000	0.0000	0.0050	2.00
	0.8674	0.8639	0.0035	0.0060	2.00
313	0.0000	0.0000	0.0000	0.0050	2.00
	0.2919	0.2907	0.0012	0.0051	2.00
350	0.0000	0.0000	0.0000	0.0050	2.00
	0.6430	0.6402	0.0028	0.0055	2.00

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REPORT OF CALIBRATION

Certificate No. : SP24-018

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	242.0	-0.28	0.18	2.00
279.45	279.5	-0.05	0.18	2.00
287.81	287.9	-0.09	0.18	2.00
334.06	333.9	0.16	0.18	2.00
360.93	360.5	0.43	0.18	2.00
418.59	418.1	0.49	0.18	2.00
445.94	445.6	0.34	0.18	2.00
453.66	453.3	0.36	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.0	0.59	0.18	2.00
637.98	638.7	-0.72	0.18	2.00
431.38	430.8	0.58	0.18	2.00
472.50	472.4	0.10	0.18	2.00
513.47	513.7	-0.23	0.18	2.00
528.88	529.1	-0.22	0.18	2.00
573.17	573.5	-0.33	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	685.1	-0.70	0.18	2.00
740.72	741.4	-0.68	0.20	2.00
748.55	749.1	-0.55	0.18	2.00
807.03	807.3	-0.27	0.18	2.00
879.28	879.3	-0.02	0.18	2.00

Remark : - UUC = Unit Under Calibration

- N/A = Not Available

- The result expanded uncertainty of measurement U is stated as the standard uncertainty of measurement multiplied by the coverage factor k ,

which for a normal distribution corresponds to a coverage probability of approximately 95%

- * Indicates non TISI accredited













- End of Certificate -

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ALS Certificate

เอกสารรับรองความสามารถของ ALS Laboratory Group (Thailand) ในขอบข่ายที่ขึ้นทะเบียน สามารถสแกนผ่าน QR CODE หรือพิมพ์ Shorten link

หน่วยงานอนุญาต	สาขาที่ขึ้นทะเบียน	ไฟล์เอกสารแนบ	รายละเอียดการขึ้นทะเบียน
กรมโรงงานอุตสาหกรรม ขึ้นทะเบียนห้องปฏิบัติการวิเคราะห์	สาขากรุงเทพ (สำนักงานใหญ่) (ว-204)	 หรือ https://bit.ly/3arPA7W	น้ำเสีย, น้ำใต้ดิน, อากาศเสียจากปล่อยระบาย, ดิน, สิ่งปฏิกูลที่ไม่ใช่แล้ว
กรมวิทยาศาสตร์การแพทย์ ได้รับการรับรอง ISO/IEC 17025 : 2017	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3Pj6Yxq	อาหาร, เครื่องดื่ม, น้ำบริโภค, น้ำใช้, น้ำแข็ง, ผักและผลไม้, เนื้อสัตว์และผลิตภัณฑ์, สัตว์น้ำ, ผลิตภัณฑ์ทางทะเล, ซอสและเครื่องปรุงรส, นมและผลิตภัณฑ์ของนม, ไขมันและน้ำมัน, ธัญพืช, เครื่องสำอาง, อุปกรณ์การแพทย์
กรมวิทยาศาสตร์บริการ ได้รับการรับรอง ISO/IEC 17025 : 2017	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3R1pWtd	น้ำ, น้ำเสีย, น้ำทะเล, น้ำในสระว่ายน้ำ, ภาชนะบรรจุอาหารและวัสดุสัมผัส, ภาชนะพลาสติก บรรจุอาหาร, อากาศ, สิ่งในสิ่งแวดล้อม, อาหารสัตว์และ วัตถุดิบอาหารสัตว์, ขนไก่ป่น
ผู้ควบคุมมลพิษด้านสิ่งแวดล้อมจาก กรมโรงงานอุตสาหกรรม	บ.123-48-029	 หรือ https://bit.ly/3tD5pjU	ระบบบำบัดมลพิษน้ำ, อากาศ, กากอุตสาหกรรม
กรมปศุสัตว์	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3nJHbDZ	อาหาร, สินค้าปศุสัตว์, อาหารสัตว์และวัตถุดิบอาหารสัตว์
กรมประมง	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3bWia4c	สัตว์น้ำและผลิตภัณฑ์สัตว์น้ำ, อาหารกระป๋อง, ปลาและ น้ำปลา, ซอสปรุงรส, เนื้อเยื่อสัตว์, เครื่องปรุงรส, ขนมน, สำหรับและผลิตภัณฑ์จากสาหร่าย
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มกอช	สาขากรุงเทพ (สำนักงานใหญ่)	 หรือ https://bit.ly/3Acyghs	อาหาร, อาหารกระป๋อง, เครื่องดื่ม, น้ำดื่ม, น้ำแข็ง, น้ำเสีย, น้ำทะเล, แป้ง, ผักผลไม้, ผลิตภัณฑ์นม, ซ็อกโกแลต, เนื้อสัตว์, ธัญพืช, สินค้าประมง, น้ำปลา, เครื่องปรุงรส, เครื่องเทศ, บรรจุภัณฑ์, วัตถุดิบอาหารสัตว์, และอื่นๆ
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		 หรือ https://bit.ly/3rvYqKI	ใบอนุญาตเป็นผู้ให้บริการตรวจวัดและวิเคราะห์ สภาวะการทำงานเกี่ยวกับระดับความร้อน
		 หรือ https://bit.ly/3skKLEX	ใบอนุญาตเป็นผู้ให้บริการตรวจวัดและวิเคราะห์ สภาวะการทำงานเกี่ยวกับระดับแสงสว่าง
		 หรือ https://bit.ly/3owAfcC	ใบอนุญาตเป็นผู้ให้บริการตรวจวัดและวิเคราะห์ สภาวะการทำงานเกี่ยวกับระดับเสียง

ติดต่อเรา

ALS Laboratory Group (Thailand) ห้องปฏิบัติการวิเคราะห์ที่ได้รับการรับรองความสามารถตามมาตรฐานสากล ISO/IEC 17025 และขึ้นทะเบียนห้องปฏิบัติการกับกรมโรงงานอุตสาหกรรม ให้บริการวิเคราะห์ทดสอบครบวงจรทั้งด้านอาหาร ยา เวชภัณฑ์ เครื่องสำอาง และสิ่งแวดล้อม ซึ่งมีความเชี่ยวชาญและประสบการณ์กว่า 38 ปี ด้วยนักวิทยาศาสตร์ที่มีความเชี่ยวชาญกว่า 400 คน พร้อมทั้งเครื่องมือและเทคโนโลยีที่ทันสมัย ปัจจุบันเรามีความพร้อมในการบริการครอบคลุมถึง 8 สาขา อันได้แก่ กรุงเทพฯ ระยอง เชียงใหม่ สงขลา สุราษฎร์ธานี นครราชสีมา หนองคาย และภูเก็ต

Contact Us

