

ภาคผนวก จ

เอกสารสอบเทียบเครื่องมือ

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
1	Office Transfer Standard Calibrator	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Andersen Instruments, Inc.	G25A 1901	Jiranatee Associates Co., Ltd.	COF-002-66	14 Jul 23	13 Jul 25	-
2	U-Tube Manometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀)	Dwyer	1221-36-W/M -	Technology Promotion Association (Thailand-Japan)	24P1251	11 Apr 24	10 Apr 25	-
3	Air Flow Meter	Particular Matter (PM _{2.5})	BGI	DeltaCal DC1 160491	Innovative Instrument Co.,Ltd.	24-AFM-193	23 Sep 24	22 Sep 25	-
4	Aneroid Barometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24P1367	22 Apr 24	21 Apr 25	-
5	Dial Thermo-Hygrometer	Total Suspended Particulate (TSP) Particulate Matter < 10 µm (PM ₁₀) Particular Matter (PM _{2.5})	Barigo, Germany	-	Technology Promotion Association (Thailand-Japan)	24H753	10 Apr 24	9 Apr 25	-
6	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thermo Scientific	GS2312-10105-1 2010-17	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
7	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thermo Scientific	GS2312-10105-1 2010-18	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
8	High Volume Air Sampler	Total Suspended Particulate (TSP)	Thermo Scientific	GS2312-10105-1 2010-19	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
9	High Volume Air Sampler	Total Suspended Particulate (TSP)	Tisch Environmental	TE-5170DX 1049	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
10	High Volume Air Sampler	Total Suspended Particulate (TSP)	Tisch Environmental	TE-5170DX 1050	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
11	High Volume Air Sampler	Total Suspended Particulate (TSP)	Tisch Environmental	TE-5170DX 1051	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
12	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thermo Scientific	IP10-1	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-

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Ambient									
13	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thremo Scientific	IP10-1	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
14	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Thremo Scientific	IP10-1	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
15	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Tisch Enviromental	TE-6070DX 1076	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
16	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Tisch Enviromental	TE-6070DX 1077	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
17	High Volume Air Sample	Particulate Matter < 10 µm (PM ₁₀)	Tisch Enviromental	TE-6070DX 1079	Jiranatee Associates Co., Ltd.	Ref. No.1901	14 Jul 23	13 Jul 25	-
18	Low Volume Air Sampler	Particular Matter (PM _{2.5})	Thremo Scientific	2000i 2000IW208211910	Innovative Instrument Co.,Ltd.	Ref. No.160491	27 Sep 23	26 Sep 24	-
19	Low Volume Air Sampler	Particular Matter (PM _{2.5})	Thremo Scientific	2000i 2000IW208221910	Innovative Instrument Co.,Ltd.	Ref. No.160491	27 Sep 23	26 Sep 24	-
20	Low Volume Air Sampler	Particular Matter (PM _{2.5})	Thremo Scientific	2000i 2000IW208231910	Innovative Instrument Co.,Ltd.	Ref. No.160491	27 Sep 23	26 Sep 24	-
21	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	05103-5 309017844	Thai Meteorological Department	173/24	11 Apr 24	10 Apr 25	-
22	Wind Speed/Wind Direction	WS/WD	LSI LASTEM	05103-5 309019236	Thai Meteorological Department	174/24	11 Apr 24	10 Apr 25	-
23	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0041	Thai Meteorological Department	119/24	13 Mar 24	12 Mar 25	-
24	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DR0052	Thai Meteorological Department	098/24	22 Feb 24	21 Feb 25	-
25	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2111DT0058	Thai Meteorological Department	121/24	13 Mar 24	12 Mar 25	-

List of Instruments Certification for Air & Noise Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration	Remark
Ambient									
26	Wind Speed/Wind Direction	WS/WD	Scarlet Tech Ltd.	WL-21 2112DR0065	Thai Meteorological Department	0977/24	22 Feb 24	21 Feb 25	-
27	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12394	Calibration Laboratory Co.Ltd	Q24059619	11 Jun 24	10 Jun 25	-
28	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12395	Calibration Laboratory Co.Ltd	Q24042942	30 Apr 24	29 Apr 25	-
29	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM11355	Calibration Laboratory Co.Ltd	Q24059622	11 Jun 24	10 Jun 25	-
30	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12888	Calibration Laboratory Co.Ltd	Q24042943	30 Apr 24	29 Apr 25	-
31	Vibration Meter	Vibration Level Acceleration Level	Instantel Inc.	Micromate UM12889	Calibration Laboratory Co.Ltd	Q24059620	11 Jun 24	10 Jun 25	-
32	Sound Level Calibrator (Acoustic Calibrator)	Calibrate Sound Level Meter	SvanteK	SV35A 73246	Innovative Instrument Co.,Ltd.	24-ACT-077	30 May 24	29 May 25	-
33	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} L_{A90} L_{A1n}	Larson Davis	LxT2 0005372	Innovative Instrument Co.,Ltd.	24-SLM-229	9 Jul 24	8 Jul 25	-
34	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} L_{A90} L_{A1n}	Larson Davis	LxT2 0005341	Innovative Instrument Co.,Ltd.	24-SLM-232	10 Jul 24	9 Jul 25	-
35	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} L_{A90} L_{A1n}	Larson Davis	LxT2 0005346	Innovative Instrument Co.,Ltd.	24-SLM-235	10 Jul 24	9 Jul 25	-
36	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} L_{A90} L_{A1n}	Larson Davis	LxT2 0006698	Innovative Instrument Co.,Ltd.	24-SLM-233	10 Jul 24	9 Jul 25	-
37	Sound Level Meter	$L_{Aeq\ 24\ hours}$ L_{Amax} L_{A90} L_{A1n}	Larson Davis	LxT2 0006699	Innovative Instrument Co.,Ltd.	24-SLM-230	10 Jul 24	9 Jul 25	-



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.: 24P1367
Page: 1 of 2

Equipment: Aneroid Barometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.152/2550
Condition As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 22 April 2024
Reference: 2404-0243WSC
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	DP142	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 Khankaew
Issue Date: 23 April 2024

Approved Signatory:
[] Phalinee Prabpaipal
[] Sura Suwannasri
[x] Attapol Panurach

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Certificate of Calibration

Certificate No.: 24H753
Page: 1 of 2

Equipment: Dial Thermo-Hygrometer
Manufacturer: Barigo
Model: -
Serial No.: -
ID No.: UAE.ANV.127/2550
Condition As-Received: Used Item
Received Date: 05 April 2024
Calibration Date: 10 April 2024 to 18 April 2024
Reference: 2404-0247WSC
Ambient Temperature: (25 ± 3) °C
Relative Humidity: (50 ± 20) %
Submitted by: United Analyst and Engineering Consultant Co.,Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangchak, Phrakhanong, 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) Chilled Mirror Hygrometer	Dew Master	44730	21656	02 Aug 2024
2) Handheld Thermometer With Sensor	1521	A5A339	2311238	16 Oct 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:-				
-Thunder Scientific Corporation, NVLAB Accreditation No. Calibration 200582-0				
-Technology Promotion Association (Thailand-Japan), NSG-ONSC Accredited No. Calibration 0008				

Calibrated by: Chakrit Waewwanjua
Issue Date: 18 April 2024

Approved Signatory:
[] Chakrit Waewwanjua
[x] Viporn Tantiyawutti
[] Unnopphol Harachai

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Cert.No.: 24P1367
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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)	957.13	968.77	980.13	990.56	1001.26	1011.35	1022.10	1032.61
UUC* Indication (hPa)	960.0	970.0	980.0	990.0	1000.0	1010.0	1020.0	1030.0
Error (hPa)	2.87	1.23	-0.13	-0.56	-1.26	-1.35	-2.10	-2.61

Decreasing Pressure

Applied Pressure (hPa)	1032.61	1021.84	1010.88	1000.82	990.20	979.52	968.48	957.17
UUC* Indication (hPa)	1030.0	1020.0	1010.0	1000.0	990.0	980.0	970.0	960.0
Error (hPa)	-2.61	-1.84	-0.88	-0.82	-0.20	0.48	1.52	2.83

The uncertainty of measurement was ± 0.25 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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Cert.No.: 24H753
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Result of Calibration:- Without Adjustment
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	43	2.9	1.6
25.0	60.0	60	0.0	1.7
25.0	80.0	78	-2.0	1.8

Result of Calibration:- Without Adjustment
Function: Temperature Measurement.

Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of Measurement (±°C)
20.014	20.0	-0.014	0.72
25.033	25.0	-0.033	0.72
30.010	30.0	-0.010	0.72
35.027	34.5	-0.527	0.72
40.013	39.5	-0.513	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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CERTIFICATE OF CALIBRATION

Certificate No. : COF-002-66

Page 1 of 2 Pages

MEASUREMENT ITEM : Top Load Office
MANUFACTURER : Anderson Instruments
MODEL/TYPE : G25A
SERIAL NUMBER : 1901
ID NUMBER : UAE.ANY.051/2547
CONDITION AS-RECEIVED : Used Item
CUSTOMER : United Analyst and Engineering Consultant Co., Ltd.
81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Phrakhanong,
Bangkok 10260

RECEIVED DATE : 07 Jul 2023
MEASUREMENT DATE : 14 Jul 2023
ISSUE DATE : 18 Jul 2023

ENVIRONMENTAL CONDITIONS
Ambient condition in the laboratory are as follow:
Temperature : 23.0 ± 3.0 °C
Relative Humidity : 55.0 ± 15.0 %RH
Atmospheric Pressure : 1010 ± 10 hPa

CALIBRATION CONDITION
Preconditioning : 24 hours at ambient conditions.
Measurement Condition : The average values during measurement are 23.9 °C and 54.5%RH.

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

TABULATION OF RESULTS:
The table on next page give the measured values.

Calibration procedure:
The Office gas flow device was calibrated against
Standard Rotary Displacement Meter (Roosts Merier)
Model GES/1MC/W2.04. The WG-004
was used as a calibration guideline.

Traceability:
This certificate provides a traceability of the
measurement to recognized the national
standards and to recognition of the international
system of units (SI) through the VSL (National
Metrology Institute of Netherlands) via Certificate
number: 02225901

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)

MEASUREMENT RESULTS:

The Office gas flow device was calibrated by direct comparison method with the Standard Rotary Displacement Meter (Roosts Merier). The humid air was used as a medium in the system. The standard conditions are 25°C (338.15 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 [Tg] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Office inH ₂ O	F	Standard Flow [Qs] m ³ /min
1	0.701	754.115	23.67	23.30	55.600	1.626	1.273	0.648
2	0.997	754.083	23.80	23.23	61.350	3.235	1.795	0.914
3	1.121	754.005	23.81	23.20	41.923	4.938	2.079	1.057
4	1.172	754.004	23.72	23.16	30.933	4.891	2.008	1.122
5	1.410	753.994	23.76	23.18	29.415	7.159	2.671	1.352

Slope (a): 1.38463
Intercept (b): -0.01636
Correlation coefficient (r): 0.99972
Uncertainty (k=2): 0.015 m³/min

Table 2: The results of Q actual calibration data

Plate	Flow rate m ³ /min	Pressure [Pa] mmHg	Temperature [Tg] °C	Temperature [Tm] °C	Ap_meter mmHg	Ap_Office inH ₂ O	F	Standard Flow [Qs] m ³ /min
1	0.701	754.115	23.67	23.30	55.600	1.626	0.800	0.651
2	0.997	754.083	23.80	23.23	61.350	3.236	1.129	0.917
3	1.121	754.005	23.81	23.20	41.923	4.338	1.307	1.061
4	1.172	754.004	23.72	23.16	30.933	4.891	1.388	1.129
5	1.410	753.994	23.76	23.18	29.415	7.159	1.679	1.357

Slope (a): 1.24306
Intercept (b): -0.01939
Correlation coefficient (r): 0.99972
Uncertainty (k=2): 0.015 m³/min

End of Certificate of Calibration

Calibrated by:
☐ Mr. Serevit Thachalad
☐ Miss Jitpisorn Lertsomphol



Approved signatory:
Mr. Parinya Boondurran
Calibration Department Manager



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THIS CERTIFICATE REPORT MAY NOT BE REPRODUCED EXCEPT IN FULL UNLESS PERMISSION FOR REPRODUCTION HAS BEEN OBTAINED IN WRITING FROM THE LABORATORY



TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)
CORPORATE SERVICES 3: EQUIPMENT CALIBRATION AND TESTING SERVICES
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TEL. 0-2717-3000-24 FAX. 0-2719-9484

Certificate of Calibration

Certificate No. : 24P1251
Page : 1 of 2

Equipment : U Tube Manometer
Manufacturer : Dwyer
Model : 1221-36-W/M
Serial No. : -
ID No. : UAE.EFM.077/2568

Condition As-Received : Used Item
Received Date : 03 April 2024
Calibration Date : 11 April 2024

Reference : 2404-0118WSC
Ambient Temperature : (23 ± 2) °C
Relative Humidity : (50 ± 15) %
Atmospheric Pressure : 1012 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 calibration procedure CP-P04, 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) Pressure Calibrator	PC106P	1189	MP-0176-23	12 Sep 2024

- This result of calibration was made on requested at the point specified by customer.
- Scale and conversion factor is 1 kPa = 4.0146293 inH₂O
- This instrument was used clean air as pressure media.
- This instrument was calibrated by applied pressure to high-port (+) side and low-port (-) side open to atmospheric pressure.
- This instrument was installed in vertical orientation and top of the pressure port was used as the reference level.
- This certificate is valid only to the item calibrated on date and place of calibration.
- This Certification is traceable to the International System of Unit maintained through:-
-National Institute of Metrology (Thailand), NSC-ONSC Accredited No. Calibration 0144

Calibrated by : Suksan Khankaew
Issue Date : 17 April 2024

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

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Corr.No.: 24P1251
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Result of calibration:- Without adjustment
Function:- Pressure Measurement
Increasing Pressure

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

Applied Pressure	High-port side	Low-port side	UUC Indication	ΔP	Error
0.00	0.00	0.00	0.00	0.00	0.00
2.00	1.00	-1.00	2.00	0.00	0.00
4.00	2.00	-2.00	4.00	0.00	0.00
6.00	3.00	-3.00	6.00	0.00	0.00
8.00	4.00	-4.00	8.00	0.00	0.00
10.00	5.00	-5.00	10.00	0.00	0.00
12.00	6.00	-6.00	12.00	0.00	0.00
14.00	7.00	-7.00	14.10	0.10	0.10
16.00	8.00	-8.00	16.10	0.10	0.10
18.00	9.00	-9.00	18.10	0.10	0.10
20.00	10.00	-10.00	20.10	0.10	0.10
22.00	11.00	-11.00	22.10	0.10	0.10
24.00	12.00	-12.00	24.10	0.10	0.10
26.00	13.00	-13.00	26.10	0.10	0.10
28.00	14.00	-14.00	28.10	0.10	0.10
30.00	15.00	-15.00	30.10	0.10	0.10
32.00	16.00	-16.10	32.15	0.15	0.15
34.00	17.00	-17.10	34.15	0.15	0.15
35.80	18.00	-18.00	36.00	0.20	0.20

The uncertainty of measurement was ± 0.11 inH₂O

* ΔP = High-port side - Low-port side

* 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

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

Certificate No : 24-AFM-193
Request No : Req-2024-2119

Unit Under Calibration Details

Measurement Item : Air Flow Meter
Manufacturer : DGI
Model : Delta Cal DC1
Serial Number : 160491
ID : UAE.EFM.175/2561

Accuracy : 0.75% of Reading
Sensor Model : -
Sensor Serial Number : -
Instrument Status : Used

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 : 10 September 2024
Calibration Date : 23 September 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 High flow	18501012012	Sensidyne	1 August 2025
Temperature meter	GT 11	08000057	Qtechon	1 March 2025
Pressure meter	CPQ2400	411008KDU/851882	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 %.

Calibration By : Mr. Noppadon Luangart
Service Calibration Engineer

Approved By : Mr. Pait Mathavorn
Calibration Engineer Supervisor
Issue Date : 23 September 2024

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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.04 Issue date 17/6/24

Certificate No : 24-AFM-193

Request No : Req-2024-2119

Result of Calibration : Without Adjustment

Temperature (°C)	Pressure (kPa)	STD (l/min)	UUC (l/min)	Error (l/min)	Uncertainty (l/min)	MPE (l/min)	Result
25.40	100.00	14.50	14.54	0.04	0.20	0.109	N/A
25.30	99.90	15.00	15.03	0.03	0.21	0.113	N/A
25.20	99.90	15.80	15.81	0.01	0.22	0.119	N/A
25.10	99.80	16.67	16.68	0.01	0.23	0.125	N/A
25.00	99.70	18.30	18.27	-0.03	0.26	0.137	N/A

Note : STD : Standard UUC : Unit Under Calibration

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

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

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

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

Meas = Measurement Condition ref = Standard Condition

* Indicates non accredited

MPE = Maximum Permissible Error (Specified in Manufacturer's Specifications)

N/A = Not Available, Customer does not require a statement of conformity.

เอกสารไม่ควบคุม

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.04 Issue date 17/6/24

Certificate No : 24-AFM-193

Request No : Req-2024-2119

Decision Rule for Statements of Conformity

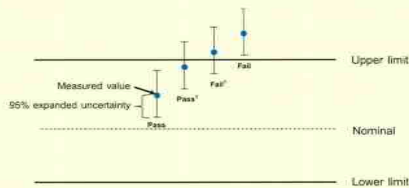
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2019: Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass¹ - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail² - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail² - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



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 Innovative Instrument Co., Ltd.

FM-708-AFM-01 Rev.04 Issue date 17/6/24

Certificate of Calibration

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

Certificate No : 24-TPM-441
Request No : Req-2024-2119
Page : 1/2

Unit Under Calibration Details

Calibration Parameter : Temperature
Instrument Name : Air Flow meter
Manufacturer : BGI
Model : Delta Cal DC1
Serial Number : 160491
Resolution : 0.1 °C
ID Number : UAE.EFM.175/2561

Range Calibration : 20 °C to 50 °C
Type of Sensor : RTD
Sensor Diameter (mm) : 3
Calibration Position (mm) : 45
Instrument Status : Used

Calibration Environment and Details

Temperature : 23 °C ± 3 °C
Humidity : 55 %RH ± 15 %RH
Received Date : 10 September 2024
Calibrated Date : 25 September 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: 08000057, ID: 02-TPM Which was calibrated on 1 March 2024, Calibration Certificate No.: QR24-0478

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 Luangart
Technical Manager
Issue Date : 25 September 2024

เอกสารไม่ควบคุม

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-TPM-01 Rev.01 Issue date 13/02/20



Calibration Note

UUC Adjustment : ☐ Not Adjust

Certificate No : 24-TPM-441

Request No : Req-2024-2119

Page : 2/2

Result of Calibration :

UUC Sensor	Standard Temperature (°C)	UUC Reading (°C)	Correction (°C)	Uncertainty (°C)
Ta	20.031	20.0	0.0	0.13
	25.034	25.0	0.0	0.13
	30.035	30.1	-0.1	0.13
	35.029	35.1	-0.1	0.13
	40.011	40.0	0.0	0.13
	45.008	45.0	0.0	0.13
Tt	50.007	50.0	0.0	0.13
	20.031	19.9	+0.1	0.13
	25.034	24.9	+0.1	0.13
	30.035	30.0	0.0	0.13
	35.029	35.0	0.0	0.13
	40.011	40.0	0.0	0.13
	45.008	44.9	+0.1	0.13
	50.007	49.9	+0.1	0.13

End of Certificate

Calibrated By :

Mr. Sirichok Jirapaksorn

เอกสารไม่ควบคุม

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-TPM-01 Rev.01 Issue date 13/02/20



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 11 April, 2024

Certification No. : 173/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG

Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 29505 Basic Datalogger : 309017844

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1007.9 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : H. Watcharapol

Signed : Mr. Pisod Promsut

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Calibration

Sub-Standard Instrument

THAI METEOROLOGICAL DEPARTMENT

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 173/24

11 April, 2024

Page : 2 of 2

Standard Ultrasonic Anemometer m/sec	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure inches	Vacuum inches	Pressure hPa	Velocity m/sec	Correction m/sec
1.00	-	-	-	0.80	0.20
3.02	-	-	-	2.98	0.04
5.00	-	-	-	5.02	-0.02
7.04	-	-	-	6.99	0.05
9.02	-	-	-	8.95	0.07
11.01	-	-	-	10.99	0.02
13.01	-	-	-	12.95	0.06
15.01	-	-	-	15.05	-0.04
17.02	-	-	-	17.00	0.02
20.02	-	-	-	20.26	-0.24

Wind Aloft Plotting Board, U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	90
180.0	180
270.0	270

Calibrated by :

H. Watcharapol

Mr. Watcharapol Subwat

Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 11 April, 2024

Certification No. : 174/24

Page : 1 of 2

Object : Wind speed and wind direction

Manufacturer : Sensor : YOUNG

Basic Datalogger : NRG

Type : Sensor : 05103-5 Basic Datalogger : LR20

Serial No. : Sensor : 79424 Basic Datalogger : 309019236

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1013.3 hPa

NATIONAL STANDARD WIND TUNNEL :

: Thermal Anemometer 642 S/N 91563

: HOOK GAGE NO 1425 Pilot Tube Theodor Friedrichs Type 0800.0000 serial 9023

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

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION

Calibrated by : H. Watcharapol

Signed : Mr. Pisod Promsut

Mr. Watcharapol Subwat

Mechanical Engineer

(Authorized Signatory)

for the Calibration

Sub-Standard Instrument

THAI METEOROLOGICAL DEPARTMENT

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 174/24

11 April, 2024

Page : 2 of 2

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Pressure	Velocity	Correction
Ultrasonic Anemometer	inches	inches	kPa	m/sec	m/sec
m/sec					
1.00	-	-	-	0.90	0.10
3.02	-	-	-	3.00	0.02
5.00	-	-	-	4.98	0.02
7.04	-	-	-	7.02	0.02
9.02	-	-	-	8.94	0.08
11.01	-	-	-	10.98	0.03
13.01	-	-	-	12.96	0.05
15.01	-	-	-	15.00	0.01
17.02	-	-	-	17.04	-0.02
20.02	-	-	-	20.10	-0.08

Wind Aloft Plotting Board	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90.0	91
180.0	182
270.0	271

Calibrated by :

Handwritten signature

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. 119/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLETT/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 2111DR0041
Wind Sensor : 2111DT0041

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

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1010.6 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer : Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number : 731241460 : Standard Velocity at 20 - 30 m/sec

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

: Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Iserlo, Iserlo 845 Serial No. 02848057 : Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB-290 No. V1220015

: Digital Barometer Vaisala Type PTB-330 No. 24320001

Calibrated by : *Handwritten signature*

Signed : *Handwritten signature*
Mr. Watcharapol Subwat
Mechanical Engineer

Authorized Signatory
for the Chief
Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H2O	inches H2O	m/sec	m/sec	m/sec
m/sec					
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	8.9	0.12
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	14.9	0.11
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

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

Calibrated by :

Handwritten signature

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1009.99	1009	0.99
1009.45	1009	0.45
1010.10	1010	0.10
1010.94	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.18	1013	0.18
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1014	-0.56
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.64	1016	-0.36
1015.23	1015	0.23
1012.67	1013	-0.13
1013.63	1014	-0.37

Average : 0.94

Calibrated by :

Handwritten signature

Mr. Watcharapol Subwat
Mechanical Engineer



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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.25	757	-0.25
757.15	757	-0.15
757.64	756	-0.36
758.27	756	-0.27
758.66	758	0.66
758.94	759	-0.06
759.11	759	0.11
759.64	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.73	762	-0.21
761.48	761	0.48
759.71	760	-0.29
760.28	760	0.28

Average 0.02

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 119/24

13 March, 2024

Page : 5 of 5

Standard Temp, °C	Temperature Sensor Reading	
	Reading °C	Correction °C
-45.1	45	0.1
-30.2	30	0.2
-15.4	15	0.4

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. : 098/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver 2111DR0052

Wind Sensor 2111DT0052

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1009.5 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Afloat Plotting Board

: Micromanometer : Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731241450 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Testo, testo 545 Serial No. 02848057 : Thermoschneider No. 918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220, No. V1220015

: Digital Barometer Vaisala Type PTB350-M, 113360001

Calibrated by :

Mr. Watcharapol Subwat

Mechanical Engineer

Signed :

Mr. Pisoot Promsat

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	inches H2O	inches H2O	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	16.9	0.12
20.02	-	-	-	19.9	0.12

Wind Afloat Plotting Board, U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.84	1011	-0.16
1010.80	1010	0.00
1011.71	1012	-0.29
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.88	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.49
1011.80	1012	-0.20
1012.06	1012	0.06
1012.91	1013	-0.19
1013.22	1013	0.22
1013.49	1013	0.49

Average 0.08

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	758	0.19
758.01	758	0.01
758.04	759	-0.16
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.66	760	-0.35
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.96	762	-0.04
761.83	762	-0.17
758.69	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.98	760	-0.02
760.18	760	0.18

Average 0.02

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 098/24

22 February, 2024

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.3	30	0.3
15.6	15	0.8

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 13 March, 2024

Certification No. : 121/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 2111DR0058

Wind Sensor : 2111DT0058

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

81 Soi Udomsuk 41, Sukhumvit Road,

Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1011.9 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Aloft Plotting Board

: Micromanometer : Theodor Friedrichs FC014 Serial No. 9310119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

: Ultrasonic Anemometer : Model DA-850-3TV (sensor TR-90AH)

Serial Number 110730029 (sensor 120629686)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

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

: Testo, testo 645 Serial No. 02648057 : ThermoSchneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. V1220015

: Digital Barometer Vaisala Type PTB350 No. V1220001

Calibrated by :
Mr. Watcharapol Subwat
Mechanical Engineer

Signed :
Mr. Pisood Premrat

(Authorized Signatory)
for the Chief
Sub-Standard Instrument

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	mmHg	mmHg	m/sec	m/sec	m/sec
1.00	-	-	-	1.0	-0.00
3.02	-	-	-	3.0	0.02
5.00	-	-	-	5.0	0.00
7.04	-	-	-	7.0	-0.04
9.02	-	-	-	9.0	0.12
11.02	-	-	-	11.0	-0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	-0.02
20.02	-	-	-	19.9	0.12

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

Calibrated by : 
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
1009.59	1009	0.59
1009.45	1010	-0.55
1010.10	1010	0.10
1010.04	1011	-0.06
1011.46	1011	0.46
1011.84	1012	-0.16
1012.06	1012	0.06
1013.04	1013	0.04
1013.16	1013	0.16
1012.89	1013	-0.11
1013.20	1013	0.20
1013.44	1013	0.44
1013.81	1014	-0.19
1014.19	1014	0.19
1015.96	1016	-0.04
1016.23	1016	0.23
1015.84	1015	0.84
1015.23	1015	0.23
1012.87	1013	-0.13
1013.63	1014	-0.37

Average 0.08

Calibrated by : 
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
757.25	757	0.25
757.15	757	0.15
757.64	758	-0.36
758.27	756	0.27
758.66	756	0.66
758.94	759	-0.06
759.11	759	0.11
759.84	760	-0.16
759.95	760	-0.05
759.73	760	-0.27
759.96	760	-0.04
760.14	760	0.14
760.42	761	-0.58
760.70	761	-0.30
762.03	762	0.03
762.24	762	0.24
761.76	762	-0.21
761.46	762	-0.52
759.71	760	-0.29
760.26	760	0.26

Average -0.03

Calibrated by : 
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

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THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 121/24

13 March, 2024

Page : 5 of 5

Standard	Temperature Sensor Reading	
	Reading	Correction
Temp. °C	°C	°C
45.1	45	0.1
30.2	30	0.2
15.4	15	-0.6

Calibrated by : 
Mr. Watcharapol Subwat
Mechanical Engineer

Calibration & Test Section
Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

Calibration Certificate

Issued by : Calibration & Test Section : Meteorological Instruments Bureau

Date of Issue : 22 February, 2024

Certification No. 097/24

Page : 1 of 5

Object : Wind Speed & Wind Direction Data Logger

Manufacturer : SCARLET/TECH

Type : WL-21

Mfg Code : Wireless Receiver : 2112DR0085

Wind Sensor : 2112DT0085

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

81 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Prakanong, Bangkok 10260.

Calibration Condition : Temperature : 25.1 °C Barometric Pressure : 1009.8 hPa

NATIONAL STANDARD WIND TUNNEL : Wind Altit Plotting Board

: Micromanometer : Theodor Friedrich FC014 Serial No. 8910119 : HOOK GAGE NO 1425

N.I.S.T. Test Reference Number 731/241460 : Standard Velocity at 20 - 30 m/sec

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

Serial Number 110730029 (Sensor 120629586)

JAPAN QUALITY ASSURANCE ORGANIZATION : Standard Velocity at 0 - 20 m/sec

STANDARD THERMOMETER : Theodor Friedrich : Dry No.8390/84 Wet No. 8389/84

: Testo, Testo 645 Serial No. 03849057 : Thermoschneider No.918802

STANDARD BAROMETER : Digital Barometer Vaisala Type PTB220 No. Y1220015

: Digital Barometer Vaisala Type PTB330 No. Y1220015

Calibrated by :

Signed :

(Authorized Signatory)

for the Chief

Sub-Standard Instrument

Mr. Watchapol Subwat

Mechanical Engineer

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 2 of 5

Standard	HOOK GAGE NO. 1425			TESTED ANEMOMETER	
	Pressure	Vacuum	Velocity	Velocity	Correction
Ultrasonic Anemometer	mbar	inches H2O	inches H2O	m/sec	m/sec
1.00	-	-	-	1.0	0.00
3.02	-	-	-	2.9	0.12
5.00	-	-	-	4.9	0.10
7.04	-	-	-	7.0	0.04
9.02	-	-	-	9.0	0.02
11.02	-	-	-	11.0	0.02
13.01	-	-	-	13.0	0.01
15.01	-	-	-	15.0	0.01
17.02	-	-	-	17.0	0.02
20.02	-	-	-	20.0	0.02

Wind Altit Plotting Board.	
U.S. DEPARTMENT OF COMMERCE WEATHER BUREAU	
WIND DIRECTION	TESTED WIND DIRECTION
0	0
90	90
180	180
270	270

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 3 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mbar
1010.54	1011	-0.16
1010.50	1011	-0.40
1011.71	1011	0.71
1012.17	1012	0.17
1012.31	1012	0.31
1012.25	1012	0.25
1012.79	1013	-0.21
1012.95	1012	0.95
1013.52	1014	-0.48
1014.16	1014	0.16
1015.79	1016	-0.21
1016.02	1016	0.02
1015.86	1016	-0.14
1015.69	1015	0.69
1011.51	1012	-0.48
1011.80	1012	-0.20
1012.06	1012	0.06
1012.81	1013	-0.19
1013.22	1013	0.22
1013.49	1014	-0.51

Average : 0.03

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

Certification No. 097/24

22 February, 2024

Page : 4 of 5

Standard Barometer	Tested Barometer	Correction
Pressure	Pressure	mmHg
758.19	756	0.19
758.01	756	0.01
758.84	758	0.84
759.19	759	0.19
759.29	759	0.29
759.25	759	0.25
759.85	759	0.85
759.77	760	-0.23
760.20	760	0.20
760.68	760	0.68
761.90	762	-0.10
762.08	762	0.08
761.98	762	-0.04
761.83	762	-0.17
758.68	759	-0.31
758.91	759	-0.09
759.11	759	0.11
759.67	760	-0.33
759.95	760	-0.05
760.18	760	0.18

Average : 0.12

Calibrated by :

Mr. Watchapol Subwat

Mechanical Engineer

Calibration & Test Section

Meteorological Instruments Bureau

เอกสารไม่ควบคุม



THAI METEOROLOGICAL DEPARTMENT

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

The Result of Calibration

22 February, 2024

Certification No. 097/24

Page : 5 of 5

Standard Temp. °C	Temperature Sensor Reading	
	Reading °C	Correction °C
45.2	45	0.2
30.3	30	0.3
15.8	16	-0.2

Calibrated by : 

Mr. Watcharapol Subwat
Mechanical Engineer



เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Phrasert Manukit 29 Yasi 4, Phrasert Manukit Rd., Latphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: sale@cali-lab.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12865/UM12865
CLID. NO. : 251801712
JOB CONTROL NO. : 230914102597

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023

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

Certificate No. Q23102597

F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Phrasert Manukit 29 Yasi 4, Phrasert Manukit Rd., Latphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: sale@cali-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12865/UM12865
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : $(23 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
2. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.
3. Accelerometer with Conditioning Amplifier, Brüel & Kjær Model 8305, 2626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-004323, Due Date 03 April 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-22, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement (EA-4/02 M:2022)"

Certificate No. Q23102597

F3-011-04/01-12

page 2 of 4

เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Phrasert Manukit 29 Yasi 4, Phrasert Manukit Rd., Latphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: sale@cali-lab.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.403	-0.003	1.9
0.5	50 Hz		0.500	0.505	-0.005	1.3
0.6	50 Hz		0.600	0.606	-0.006	1.3
0.7	50 Hz		0.700	0.708	-0.008	1.3
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.9
0.5	100 Hz		0.500	0.505	-0.005	1.3
0.6	100 Hz		0.600	0.607	-0.007	1.3
0.7	100 Hz		0.700	0.712	-0.012	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.025	-0.025	1.8
4	50 Hz		4.000	4.033	-0.033	1.8
5	50 Hz		5.000	5.054	-0.054	1.8
6	50 Hz		6.000	6.067	-0.067	1.8
7	50 Hz		7.000	7.087	-0.087	1.8
3	100 Hz	peak	3.000	3.029	-0.029	1.8
4	100 Hz		4.000	4.036	-0.036	1.8
5	100 Hz		5.000	5.046	-0.046	1.8
6	100 Hz		6.000	6.072	-0.072	1.8
7	100 Hz		7.000	7.093	-0.093	1.8

Certificate No. Q23102597

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เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co., LTD.

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Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cali-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.051	-0.001	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz		0.070	0.071	-0.001	1.2
0.03	100 Hz	peak	0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

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

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

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

End of Certificate

Certificate No. Q23102597
F3-011-04/01-12

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12867/UM12867
CLID. NO. : 251801711
JOB CONTROL NO. : 230914102592

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023



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

Certificate No. Q23102592
F3-011-04/01-12

page 1 of 4



เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Prasert Manukul 29 Yaek 4, Prasert Manukul Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cali-lab.com



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Prasert Manukul 29 Yaek 4, Prasert Manukul Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cali-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12867/UM12867
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
- Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.
- Accelerometer with Conditioning Amplifier, Bruel & Kjaer Model 8305, 3626 S/N. 705491, 1741406.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 03 April 2024.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-23, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23102592
F3-011-04/01-12

page 2 of 4



เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment
CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.9
0.5	50 Hz		0.500	0.504	-0.004	1.3
0.6	50 Hz		0.600	0.607	-0.007	1.3
0.7	50 Hz		0.700	0.709	-0.009	1.3
0.3	100 Hz	peak	0.300	0.302	-0.002	1.9
0.4	100 Hz		0.400	0.406	-0.006	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.3
0.6	100 Hz		0.600	0.608	-0.008	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.052	-0.052	1.8
4	50 Hz		4.000	4.045	-0.045	1.8
5	50 Hz		5.000	5.058	-0.058	1.8
6	50 Hz		6.000	6.069	-0.069	1.8
7	50 Hz		7.000	7.078	-0.078	1.8
3	100 Hz	peak	3.000	3.045	-0.045	1.8
4	100 Hz		4.000	4.056	-0.056	1.8
5	100 Hz		5.000	5.089	-0.089	1.8
6	100 Hz		6.000	6.094	-0.094	1.8
7	100 Hz		7.000	7.101	-0.101	1.8

Certificate No. Q23102592
F3-011-04/01-12

page 3 of 4



เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Praset Manukit 29 Yaek 4, Praset Manukit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Praset Manukit 29 Yaek 4, Praset Manukit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

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

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

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

This report is valid for the above stated instruments only.

End of Certificate

Certificate No. Q23102592
F3-011-04/01-12

page 4 of 4



เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12891/UM12891
CLID. NO. : 251900056
JOB CONTROL NO. : 231106122682

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

DATE OF RECEIVED : 06 November 2023

DATE OF ISSUED : 09 November 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
09 November 2023

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

Certificate No. Q23122682
F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Praset Manukit 29 Yaek 4, Praset Manukit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



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210-11,14,55 Soi Praset Manukit 29 Yaek 4, Praset Manukit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12891/UM12891
DATE OF CALIBRATION : 07 November 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Vibration Calibrator, The Model Shop Model 9110D S/N. 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23122682
F3-011-04/01-12

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment
CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.407	-0.007	1.9
0.5	50 Hz		0.500	0.509	-0.009	1.9
0.6	50 Hz		0.600	0.610	-0.010	1.9
0.7	50 Hz		0.700	0.712	-0.012	1.9
0.3	100 Hz	peak	0.300	0.297	+0.003	1.9
0.4	100 Hz		0.400	0.394	+0.006	1.9
0.5	100 Hz		0.500	0.493	+0.007	1.9
0.6	100 Hz		0.600	0.591	+0.009	1.9
0.7	100 Hz		0.700	0.689	+0.011	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.051	-0.051	1.9
4	50 Hz		4.000	4.069	-0.069	1.9
5	50 Hz		5.000	5.079	-0.079	1.9
6	50 Hz		6.000	6.093	-0.093	1.9
7	50 Hz		7.000	7.123	-0.123	1.9
3	100 Hz	peak	3.000	3.010	-0.010	1.9
4	100 Hz		4.000	4.021	-0.021	1.9
5	100 Hz		5.000	5.034	-0.034	1.9
6	100 Hz		6.000	6.044	-0.044	1.9
7	100 Hz		7.000	7.051	-0.051	1.9

Certificate No. Q23122682
F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 15 Soi Phrom Manukul 28 Yek 4, Phrom Manukul Rd., Ladprao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: info@ccl-lab.com



CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: info@ccl-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.060	0.000	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 099 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23122682

F3-011-04/01-12

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13204/UM13204
CLID. NO. : 251900274
JOB CONTROL NO. : 231019117020

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

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

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

Calibrated By : Suwit Phmanbusabong
Calibration Engineer

Approved By : Mongkol Youtsoontorn
Authorized Signatory
25 October 2023



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

Certificate No. Q23117020

F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 15 Soi Phrom Manukul 28 Yek 4, Phrom Manukul Rd., Ladprao, Bangkok 10230
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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: info@ccl-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13204/UM13204
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Vibration Calibrator, The Modal Shop Model 9110D S/N: 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N: 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N: SM607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0930-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)".

Certificate No. Q23117020

F3-011-04/01-12

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.308	-0.008	1.9
0.4	50 Hz		0.400	0.409	-0.009	1.9
0.5	50 Hz		0.500	0.509	-0.009	1.9
0.6	50 Hz		0.600	0.610	-0.010	1.9
0.7	50 Hz		0.700	0.711	-0.011	1.9
0.3	100 Hz	peak	0.300	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.508	-0.008	1.9
0.6	100 Hz		0.600	0.608	-0.008	1.9
0.7	100 Hz		0.700	0.710	-0.010	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.099	3.062	-0.062	1.9
4	50 Hz		4.000	4.076	-0.076	1.9
5	50 Hz		5.001	5.088	-0.088	1.9
6	50 Hz		6.000	6.092	-0.092	1.9
7	50 Hz		7.000	7.106	-0.106	1.9
3	100 Hz	peak	3.000	3.061	-0.061	1.9
4	100 Hz		4.000	4.071	-0.071	1.9
5	100 Hz		5.000	5.083	-0.083	1.9
6	100 Hz		6.000	6.090	-0.090	1.9
7	100 Hz		7.000	7.097	-0.097	1.9

Certificate No. Q23117020

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukit 29 Yark 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



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210-11,14,55 Soi Prasert Manukit 29 Yark 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	-0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.051	-0.001	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.051	-0.001	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23117020
F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukit 29 Yark 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13205/UM13205
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 3) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607191.
2. Digital Multimeter, Keysight Technologies Model 3458A, S/N. MY59352733.
3. Accelerometer with Conditioning Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 03 April 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-22, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)".

Certificate No. Q23102593
F3-011-04/01-12

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เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13205/UM13205
CLID. NO. : 251900275
JOB CONTROL NO. : 230914102593

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023

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

Certificate No. Q23102593
F3-011-04/01-12

page 1 of 4

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CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukit 29 Yark 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.303	-0.003	1.9
0.4	50 Hz		0.400	0.405	-0.005	1.9
0.5	50 Hz		0.500	0.506	-0.006	1.3
0.6	50 Hz		0.600	0.607	-0.007	1.3
0.7	50 Hz		0.700	0.710	-0.010	1.3
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.506	-0.006	1.3
0.6	100 Hz		0.600	0.607	-0.007	1.3
0.7	100 Hz		0.700	0.709	-0.009	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.039	-0.039	1.8
4	50 Hz		4.000	4.051	-0.051	1.8
5	50 Hz		5.000	5.062	-0.062	1.8
6	50 Hz		6.000	6.078	-0.078	1.8
7	50 Hz		7.000	7.081	-0.081	1.8
3	100 Hz	peak	3.000	3.037	-0.037	1.8
4	100 Hz		4.000	4.046	-0.046	1.8
5	100 Hz		5.000	5.073	-0.073	1.8
6	100 Hz		6.000	6.088	-0.088	1.8
7	100 Hz		7.000	7.121	-0.121	1.8

Certificate No. Q23102593
F3-011-04/01-12

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เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co.,LTD.

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CALIBRATION DATA

3. DISPLACEMENT RESULT

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

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

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

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

End of Certificate

Certificate No. Q23102593

F3-011-04/01-12

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12867/UM12867
CLID. NO. : 251801711
JOB CONTROL NO. : 230914102592

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023

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

Certificate No. Q23102592

F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

2119-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail: info@cali-laboratory.com



CALIBRATION LABORATORY Co.,LTD.

2119-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail: info@cali-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12867/UM12867
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
2. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.
3. Accelerometer with Conditioning Amplifier, Bruel & Kjaer Model 8305, 3626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 03 April 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-23, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23102592

F3-011-04/01-12

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.9
0.5	50 Hz		0.500	0.504	-0.004	1.3
0.6	50 Hz		0.600	0.607	-0.007	1.3
0.7	50 Hz		0.700	0.709	-0.009	1.3
0.3	100 Hz	peak	0.300	0.302	-0.002	1.9
0.4	100 Hz		0.400	0.406	-0.006	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.3
0.6	100 Hz		0.600	0.608	-0.008	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.052	-0.052	1.8
4	50 Hz		4.000	4.045	-0.045	1.8
5	50 Hz		5.000	5.058	-0.058	1.8
6	50 Hz		6.000	6.069	-0.069	1.8
7	50 Hz		7.000	7.078	-0.078	1.8
3	100 Hz	peak	3.000	3.045	-0.045	1.8
4	100 Hz		4.000	4.056	-0.056	1.8
5	100 Hz		5.000	5.089	-0.089	1.8
6	100 Hz		6.000	6.094	-0.094	1.8
7	100 Hz		7.000	7.101	-0.101	1.8

Certificate No. Q23102592

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Praset Manulit 29 Yaek 4, Praset Manulit Rd., Ladphrae, Bangkok 10230
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CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Praset Manulit 29 Yaek 4, Praset Manulit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

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

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

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

This report is valid for the above stated instruments only.

End of Certificate

Certificate No. Q23102592
F3-011-04/01-12

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12891/UM12891
CLID. NO. : 251900056
JOB CONTROL NO. : 231106122682

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

DATE OF RECEIVED : 06 November 2023

DATE OF ISSUED : 09 November 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
09 November 2023

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

Certificate No. Q23122682
F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

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Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Praset Manulit 29 Yaek 4, Praset Manulit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12891/UM12891
DATE OF CALIBRATION : 07 November 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23122682
F3-011-04/01-12

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment
CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.407	-0.007	1.9
0.5	50 Hz		0.500	0.509	-0.009	1.9
0.6	50 Hz		0.600	0.610	-0.010	1.9
0.7	50 Hz		0.700	0.712	-0.012	1.9
0.3	100 Hz	peak	0.300	0.297	+0.003	1.9
0.4	100 Hz		0.400	0.394	+0.006	1.9
0.5	100 Hz		0.500	0.493	+0.007	1.9
0.6	100 Hz		0.600	0.591	+0.009	1.9
0.7	100 Hz		0.700	0.689	+0.011	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.051	-0.051	1.9
4	50 Hz		4.000	4.069	-0.069	1.9
5	50 Hz		5.000	5.079	-0.079	1.9
6	50 Hz		6.000	6.093	-0.093	1.9
7	50 Hz		7.000	7.123	-0.123	1.9
3	100 Hz	peak	3.000	3.010	-0.010	1.9
4	100 Hz		4.000	4.021	-0.021	1.9
5	100 Hz		5.000	5.034	-0.034	1.9
6	100 Hz		6.000	6.044	-0.044	1.9
7	100 Hz		7.000	7.051	-0.051	1.9

Certificate No. Q23122682

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: info@ccl-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.060	0.000	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 099 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23122682

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13204/UM13204
CLID. NO. : 251900274
JOB CONTROL NO. : 231019117020

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

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

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

Calibrated By : Suwit Phmanbusabong
Calibration Engineer

Approved By : Mongkol Youtsoontorn
Authorized Signatory
25 October 2023



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

Certificate No. Q23117020

F3-011-04/01-12

page 1 of 4



เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 15 Soi Phrom Manukul 28 Yakk 4, Phrom Manukul Rd., Ladprao, Bangkok 10230
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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2672 www.ccl-lab.com E-mail: info@ccl-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13204/UM13204
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N: 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N: 3146A75935.
3. Programmable Timer/Counter, Philips Model PM6680B S/N: SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0930-23, Due Date 26 June 2024.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)".

Certificate No. Q23117020

F3-011-04/01-12

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.308	-0.008	1.9
0.4	50 Hz		0.400	0.409	-0.009	1.9
0.5	50 Hz		0.500	0.509	-0.009	1.9
0.6	50 Hz		0.600	0.610	-0.010	1.9
0.7	50 Hz		0.700	0.711	-0.011	1.9
0.3	100 Hz	peak	0.300	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.508	-0.008	1.9
0.6	100 Hz		0.600	0.608	-0.008	1.9
0.7	100 Hz		0.700	0.710	-0.010	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.099	3.062	-0.062	1.9
4	50 Hz		4.000	4.076	-0.076	1.9
5	50 Hz		5.001	5.088	-0.088	1.9
6	50 Hz		6.000	6.092	-0.092	1.9
7	50 Hz		7.000	7.106	-0.106	1.9
3	100 Hz	peak	3.000	3.061	-0.061	1.9
4	100 Hz		4.000	4.071	-0.071	1.9
5	100 Hz		5.000	5.083	-0.083	1.9
6	100 Hz		6.000	6.090	-0.090	1.9
7	100 Hz		7.000	7.097	-0.097	1.9

Certificate No. Q23117020

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

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CALIBRATION LABORATORY Co.,LTD.

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Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	-0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.051	-0.001	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.051	-0.001	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23117020
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CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13205/UM13205
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 3) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607191.
2. Digital Multimeter, Keysight Technologies Model 3458A, S/N. MY59352733.
3. Accelerometer with Conditioning Amplifier, Bruel & Kjaer Model 8305, 2626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 03 April 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-22, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)".

Certificate No. Q23102593
F3-011-04/01-12

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เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13205/UM13205
CLID. NO. : 251900275
JOB CONTROL NO. : 230914102593

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023

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

Certificate No. Q23102593
F3-011-04/01-12

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CALIBRATION LABORATORY Co.,LTD.

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Tel: 02-579-0353-4 Fax: 02-579-2672 www.cal-labatory.com E-mail:sale@cal-labatory.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.303	-0.003	1.9
0.4	50 Hz		0.400	0.405	-0.005	1.9
0.5	50 Hz		0.500	0.506	-0.006	1.3
0.6	50 Hz		0.600	0.607	-0.007	1.3
0.7	50 Hz		0.700	0.710	-0.010	1.3
0.3	100 Hz	peak	0.300	0.303	-0.003	1.9
0.4	100 Hz		0.400	0.405	-0.005	1.9
0.5	100 Hz		0.500	0.506	-0.006	1.3
0.6	100 Hz		0.600	0.607	-0.007	1.3
0.7	100 Hz		0.700	0.709	-0.009	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.039	-0.039	1.8
4	50 Hz		4.000	4.051	-0.051	1.8
5	50 Hz		5.000	5.062	-0.062	1.8
6	50 Hz		6.000	6.078	-0.078	1.8
7	50 Hz		7.000	7.081	-0.081	1.8
3	100 Hz	peak	3.000	3.037	-0.037	1.8
4	100 Hz		4.000	4.046	-0.046	1.8
5	100 Hz		5.000	5.073	-0.073	1.8
6	100 Hz		6.000	6.088	-0.088	1.8
7	100 Hz		7.000	7.121	-0.121	1.8

Certificate No. Q23102593
F3-011-04/01-12

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Tel. 02-578-0303-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

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

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

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

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

End of Certificate

Certificate No. Q23102593

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UMI1356/UMI1356
CLID. NO. : 251701398
JOB CONTROL NO. : 231019117017

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

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

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

Calibrated By : Suwit Phanbusabong
Calibration Engineer

Approved By : Mongkol Yotsuontorn
Authorized Signatory
25 October 2023



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

Certificate No. Q23117017

F3-011-04/01-12

page 1 of 4

เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Praset Manukit 29 Yaek 4, Praset Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0303-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Praset Manukit 29 Yaek 4, Praset Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0303-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UMI1356/UMI1356
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)".

Certificate No. Q23117017

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เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.406	-0.006	1.9
0.5	50 Hz		0.500	0.507	-0.007	1.9
0.6	50 Hz		0.600	0.608	-0.008	1.9
0.7	50 Hz		0.700	0.709	-0.009	1.9
0.3	100 Hz	peak	0.300	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.9
0.6	100 Hz		0.600	0.608	-0.008	1.9
0.7	100 Hz		0.700	0.710	-0.010	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.048	-0.048	1.9
4	50 Hz		4.000	4.059	-0.059	1.9
5	50 Hz		5.000	5.067	-0.067	1.9
6	50 Hz		6.000	6.072	-0.072	1.9
7	50 Hz		7.000	7.091	-0.091	1.9
3	100 Hz	peak	3.000	3.049	-0.049	1.9
4	100 Hz		4.000	4.051	-0.051	1.9
5	100 Hz		5.000	5.069	-0.069	1.9
6	100 Hz		6.000	6.082	-0.082	1.9
7	100 Hz		7.000	7.098	-0.098	1.9

Certificate No. Q23117017

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Phasert Manukit 29 Yaso 4, Phasert Manukit Rd., Latphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2872 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Phasert Manukit 29 Yaso 4, Phasert Manukit Rd., Latphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2872 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading (mm)	DUC Reading (mm)	Correction (mm)	Uncertainty ± (% of rdg.)
(mm)	(frequency)					
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	-0.000	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23117017

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Phasert Manukit 29 Yaso 4, Phasert Manukit Rd., Latphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2872 www.cali-lab.com E-mail: info@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UMI2865/UMI2865
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

1. Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
2. Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.
3. Accelerometer with Conditioning Amplifier, Brüel & Kjær Model 8305, 2626 S/N. 705491, 1741406.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-004323, Due Date 03 April 2024.
2. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
3. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-22, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23102597

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เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UMI2865/UMI2865
CLID. NO. : 251801712
JOB CONTROL NO. : 230914102597

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

[Signature]

Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023



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

Certificate No. Q23102597

F3-011-04/01-12

page 1 of 4

เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co.,LTD.

210-11,14,55 Soi Phasert Manukit 29 Yaso 4, Phasert Manukit Rd., Latphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2872 www.cali-lab.com E-mail: info@cal-lab.com



CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading (g)	DUC Reading (g)	Correction (g)	Uncertainty ± (% of rdg.)
(g)	(frequency)					
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.403	-0.003	1.9
0.5	50 Hz		0.500	0.505	-0.005	1.3
0.6	50 Hz		0.600	0.606	-0.006	1.3
0.7	50 Hz		0.700	0.708	-0.008	1.3
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.9
0.5	100 Hz		0.500	0.505	-0.005	1.3
0.6	100 Hz		0.600	0.607	-0.007	1.3
0.7	100 Hz		0.700	0.712	-0.012	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading (mm/s)	DUC Reading (mm/s)	Correction (mm/s)	Uncertainty ± (% of rdg.)
(mm/s)	(frequency)					
3	50 Hz	peak	3.000	3.025	-0.025	1.8
4	50 Hz		4.000	4.033	-0.033	1.8
5	50 Hz		5.000	5.054	-0.054	1.8
6	50 Hz		6.000	6.067	-0.067	1.8
7	50 Hz		7.000	7.087	-0.087	1.8
3	100 Hz	peak	3.000	3.029	-0.029	1.8
4	100 Hz		4.000	4.036	-0.036	1.8
5	100 Hz		5.000	5.046	-0.046	1.8
6	100 Hz		6.000	6.072	-0.072	1.8
7	100 Hz		7.000	7.093	-0.093	1.8

Certificate No. Q23102597

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เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
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210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cali-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
*0.03	50 Hz	peak	0.030	0.030	0.000	2.1
*0.04	50 Hz		0.040	0.040	0.000	1.7
*0.05	50 Hz		0.050	0.051	-0.001	1.5
*0.06	50 Hz		0.060	0.061	-0.001	1.3
*0.07	50 Hz	peak	0.070	0.071	-0.001	1.2
0.03	100 Hz		0.030	0.030	0.000	2.1
0.04	100 Hz		0.040	0.040	0.000	1.7
0.05	100 Hz		0.050	0.050	0.000	1.5
0.06	100 Hz		0.060	0.061	-0.001	1.3
0.07	100 Hz		0.070	0.071	-0.001	1.2

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

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

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

End of Certificate

Certificate No. Q23102597
F3-011-04/01-12

page 4 of 4



เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12867/UM12867
CLID. NO. : 251801711
JOB CONTROL NO. : 230914102592

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

DATE OF RECEIVED : 14 September 2023

DATE OF ISSUED : 19 September 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

Approved By : Mongkol Yotsontorn
Authorized Signatory
19 September 2023



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

Certificate No. Q23102592
F3-011-04/01-12

page 1 of 4



เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cali-lab.com



CALIBRATION LABORATORY Co., LTD.

210-11, 14, 55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cali-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12867/UM12867
DATE OF CALIBRATION : 15 September 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.
- Digital Multimeter, Keysight Technologies Model 3458A S/N. MY59352733.
- Accelerometer with Conditioning Amplifier, Bruel & Kjaer Model 8305, 3626 S/N. 705491, 1741406.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 03 April 2024.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. EE-00010-23, Due Date 27 March 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0025-23, Due Date 12 October 2023.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23102592
F3-011-04/01-12

page 2 of 4



เอกสารไม่ควบคุม

CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment
CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.9
0.5	50 Hz		0.500	0.504	-0.004	1.3
0.6	50 Hz		0.600	0.607	-0.007	1.3
0.7	50 Hz	peak	0.700	0.709	-0.009	1.3
0.3	100 Hz		0.300	0.302	-0.002	1.9
0.4	100 Hz		0.400	0.406	-0.006	1.9
0.5	100 Hz		0.500	0.507	-0.007	1.3
0.6	100 Hz		0.600	0.608	-0.008	1.3
0.7	100 Hz		0.700	0.711	-0.011	1.3

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.052	-0.052	1.8
4	50 Hz		4.000	4.045	-0.045	1.8
5	50 Hz		5.000	5.058	-0.058	1.8
6	50 Hz		6.000	6.069	-0.069	1.8
7	50 Hz	peak	7.000	7.078	-0.078	1.8
3	100 Hz		3.000	3.045	-0.045	1.8
4	100 Hz		4.000	4.056	-0.056	1.8
5	100 Hz		5.000	5.089	-0.089	1.8
6	100 Hz		6.000	6.094	-0.094	1.8
7	100 Hz		7.000	7.101	-0.101	1.8

Certificate No. Q23102592
F3-011-04/01-12

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Praset Manulit 29 Yaek 4, Praset Manulit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



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Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

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

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

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

This report is valid for the above stated instruments only.

End of Certificate

Certificate No. Q23102592
F3-011-04/01-12

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เอกสารไม่ควบคุม

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12891/UM12891
CLID. NO. : 251900056
JOB CONTROL NO. : 231106122682

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

DATE OF RECEIVED : 06 November 2023

DATE OF ISSUED : 09 November 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
09 November 2023

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

Certificate No. Q23122682
F3-011-04/01-12

page 1 of 4



เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Praset Manulit 29 Yaek 4, Praset Manulit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Praset Manulit 29 Yaek 4, Praset Manulit Rd., Ladphrae, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: info@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12891/UM12891
DATE OF CALIBRATION : 07 November 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

- Vibration Calibrator, The Model Shop Model 9110D S/N. 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q23122682
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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment
CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.305	-0.005	1.9
0.4	50 Hz		0.400	0.407	-0.007	1.9
0.5	50 Hz		0.500	0.509	-0.009	1.9
0.6	50 Hz		0.600	0.610	-0.010	1.9
0.7	50 Hz		0.700	0.712	-0.012	1.9
0.3	100 Hz	peak	0.300	0.297	+0.003	1.9
0.4	100 Hz		0.400	0.394	+0.006	1.9
0.5	100 Hz		0.500	0.493	+0.007	1.9
0.6	100 Hz		0.600	0.591	+0.009	1.9
0.7	100 Hz		0.700	0.689	+0.011	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.051	-0.051	1.9
4	50 Hz		4.000	4.069	-0.069	1.9
5	50 Hz		5.000	5.079	-0.079	1.9
6	50 Hz		6.000	6.093	-0.093	1.9
7	50 Hz		7.000	7.123	-0.123	1.9
3	100 Hz	peak	3.000	3.010	-0.010	1.9
4	100 Hz		4.000	4.021	-0.021	1.9
5	100 Hz		5.000	5.034	-0.034	1.9
6	100 Hz		6.000	6.044	-0.044	1.9
7	100 Hz		7.000	7.051	-0.051	1.9

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CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.060	0.000	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 099 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23122682

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CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13204/UM13204
CLID. NO. : 251900274
JOB CONTROL NO. : 231019117020

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

DATE OF RECEIVED : 19 October 2023

DATE OF ISSUED : 25 October 2023

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

Calibrated By : Suwit Phmanbusabong
Calibration Engineer

Approved By : Mongkol Youtsoontorn
Authorized Signatory
25 October 2023



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

Certificate No. Q23117020

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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13204/UM13204
DATE OF CALIBRATION : 20 October 2023

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator

Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

1. Vibration Calibrator, The Modal Shop Model 9110D S/N: 11424.
2. Digital Multimeter, Hewlett Packard Model 34401A S/N: 3146A75935.
3. Programmable Timer/Counter, Philips Model PM6680B S/N: SM607101.

TRACEABILITY :

1. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0930-23, Due Date 26 June 2024.
2. The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
3. The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q23117020

F3-011-04/01-12

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CONDITION OF CALIBRATION ITEM : GOOD

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.308	-0.008	1.9
0.4	50 Hz		0.400	0.409	-0.009	1.9
0.5	50 Hz		0.500	0.509	-0.009	1.9
0.6	50 Hz		0.600	0.610	-0.010	1.9
0.7	50 Hz		0.700	0.711	-0.011	1.9
0.3	100 Hz	peak	0.300	0.306	-0.006	1.9
0.4	100 Hz		0.400	0.407	-0.007	1.9
0.5	100 Hz		0.500	0.508	-0.008	1.9
0.6	100 Hz		0.600	0.608	-0.008	1.9
0.7	100 Hz		0.700	0.710	-0.010	1.9

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.099	3.062	-0.062	1.9
4	50 Hz		4.000	4.076	-0.076	1.9
5	50 Hz		5.001	5.088	-0.088	1.9
6	50 Hz		6.000	6.092	-0.092	1.9
7	50 Hz		7.000	7.106	-0.106	1.9
3	100 Hz	peak	3.000	3.061	-0.061	1.9
4	100 Hz		4.000	4.071	-0.071	1.9
5	100 Hz		5.000	5.083	-0.083	1.9
6	100 Hz		6.000	6.090	-0.090	1.9
7	100 Hz		7.000	7.097	-0.097	1.9

Certificate No. Q23117020

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CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.051	-0.001	2.2
0.06	50 Hz		0.060	0.061	-0.001	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.051	-0.001	2.2
0.06	100 Hz		0.060	0.061	-0.001	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23117020
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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12394/UM12394 [UAE.EFM.091/2560]
DATE OF CALIBRATION : 11 June 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24, Due Date 13 May 2025.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0052-23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24059619
F3-011-05/12-23

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CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.061	-0.001	1.8
0.07	50 Hz		0.070	0.071	-0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.061	-0.001	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

End of Certificate

Certificate No. Q24059619
F3-011-05/12-23

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เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12395/UM12395
CLID. NO. : 251801350
JOB CONTROL NO. : 240429042942
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 29 April 2024

DATE OF ISSUED : 03 May 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Surwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsosontorn
Authorized Signatory
03 May 2024

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

Certificate No. Q24042942
F3-011-05/12-23

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เอกสารไม่ควบคุม



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12395/UM12395
DATE OF CALIBRATION : 30 April 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

The calibration was performed by using Digital Multimeter, Universal Counter.

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model 1281 S/N: 29320
- Universal Counter, Hewlett Packard Model 5315A S/N: 2448A13042
- Accelerometer with Measuring Amplifier, Brüel & Kjær Model 8305, 2525 S/N: 397018, 2434988.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0159/23, Due Date 04 December 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0052/23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24042942
F3-011-05/12-23

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เอกสารไม่ควบคุม



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.404	-0.004	1.6
0.5	50 Hz		0.500	0.505	-0.005	1.6
0.6	50 Hz		0.600	0.607	-0.007	2.3
0.7	50 Hz		0.700	0.708	-0.008	2.5
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.6
0.5	100 Hz		0.500	0.506	-0.006	1.6
0.6	100 Hz		0.600	0.607	-0.007	2.5
0.7	100 Hz		0.700	0.709	-0.009	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.013	-0.013	1.8
4	50 Hz		4.000	4.026	-0.026	1.8
5	50 Hz		5.000	5.033	-0.033	1.8
6	50 Hz		6.000	6.049	-0.049	1.8
7	50 Hz		7.000	7.061	-0.061	1.8
*3	100 Hz	peak	3.000	3.025	-0.025	1.6
*4	100 Hz		4.000	4.039	-0.039	1.6
*5	100 Hz		5.000	5.044	-0.044	1.6
*6	100 Hz		6.000	6.061	-0.061	1.5
*7	100 Hz		7.000	7.077	-0.077	1.5

Certificate No. Q24042942
F3-011-05/12-23

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เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-lab-thailand.com E-mail:sale@cal-lab-thailand.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.061	-0.001	1.8
0.07	50 Hz		0.070	0.071	-0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.061	-0.001	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

Certificate No. Q24042942

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-lab-thailand.com E-mail:sale@cal-lab-thailand.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11355/UM11355 [UAE.EFM.002/2560]
CLID. NO. : 252000637
JOB CONTROL NO. : 240608059622
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 08 June 2024

DATE OF ISSUED : 12 June 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer

[Signature]



Approved By : Mongkol Yotsontorn
Authorized Signatory
12 June 2024

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

Certificate No. Q24059622

F3-011-05/12-23

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cal-lab-thailand.com E-mail:sale@cal-lab-thailand.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11355/UM11355 [UAE.EFM.002/2560]
DATE OF CALIBRATION : 11 June 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0050/24, Due Date 13 May 2025.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0052-23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24059622

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.298	+0.002	1.9
0.4	50 Hz		0.400	0.397	+0.003	1.6
0.5	50 Hz		0.500	0.496	+0.004	1.6
0.6	50 Hz		0.600	0.594	+0.006	2.5
0.7	50 Hz		0.700	0.693	+0.007	2.5
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.399	+0.001	1.6
0.5	100 Hz		0.500	0.497	+0.003	1.6
0.6	100 Hz		0.600	0.596	+0.004	2.5
0.7	100 Hz		0.700	0.696	+0.004	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.013	-0.013	1.8
4	50 Hz		4.000	4.028	-0.028	1.8
5	50 Hz		5.000	5.036	-0.036	1.8
6	50 Hz		6.000	6.039	-0.039	1.8
7	50 Hz		7.000	7.048	-0.048	1.8
*3	100 Hz	peak	3.000	3.014	-0.014	1.6
*4	100 Hz		4.000	4.021	-0.021	1.6
*5	100 Hz		5.000	5.029	-0.029	1.6
*6	100 Hz		6.000	6.032	-0.032	1.5
*7	100 Hz		7.000	7.038	-0.038	1.5

Certificate No. Q24059622

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CALIBRATION LABORATORY Co., LTD.

2110-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail:sale@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	-0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.059	+0.001	1.8
0.07	50 Hz		0.070	0.069	+0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.059	+0.001	1.8
0.07	100 Hz		0.070	0.069	+0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

End of Certificate

Certificate No. Q2405622

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

2110-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail:sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12888/UM12888
DATE OF CALIBRATION : 30 April 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

The calibration was performed by using Digital Multimeter, Universal Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model 1281 S/N. 29320.
- Universal Counter, Hewlett Packard Model 5315A S/N. 2448A13042.
- Accelerometer with Measuring Amplifier, Bruel & Kjaer Model 8305, 2525 S/N. 397018, 2414988.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0159/23, Due Date 04 December 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0952-23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24042943

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

2110-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphras, Bangkok 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-laboratory.com E-mail:sale@cal-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.301	-0.001	1.9
0.4	50 Hz		0.400	0.402	-0.002	1.6
0.5	50 Hz		0.500	0.503	-0.003	1.6
0.6	50 Hz		0.600	0.605	-0.005	2.5
0.7	50 Hz		0.700	0.707	-0.007	2.5
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.6
0.5	100 Hz		0.500	0.504	-0.004	1.6
0.6	100 Hz		0.600	0.606	-0.006	2.5
0.7	100 Hz		0.700	0.707	-0.007	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	2.988	+0.012	1.8
4	50 Hz		4.000	3.967	+0.033	1.8
5	50 Hz		5.000	4.932	+0.068	1.8
6	50 Hz		6.000	5.919	+0.081	1.8
7	50 Hz		7.000	6.904	+0.096	1.8
*3	100 Hz	peak	3.000	2.987	+0.013	1.6
*4	100 Hz		4.000	3.976	+0.024	1.6
*5	100 Hz		5.000	4.965	+0.035	1.6
*6	100 Hz		6.000	5.956	+0.044	1.5
*7	100 Hz		7.000	6.944	+0.056	1.5

Certificate No. Q24042943

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เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co., LTD.

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



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.060	0.000	1.8
0.07	50 Hz		0.070	0.069	+0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.059	+0.001	1.8
0.07	100 Hz		0.070	0.069	+0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

Certificate No. Q24042943

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CALIBRATION LABORATORY Co., LTD.

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



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12889/UM12889 [UAE.EFM.005/2561]
CLID. NO. : 251801805
JOB CONTROL NO. : 24068059620
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 08 June 2024

DATE OF ISSUED : 12 June 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
12 June 2024

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

Certificate No. Q24059620

F3-011-05/12-23

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CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok, 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: sale@cali-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM12889/UM12889 [UAE.EFM.005/2561]
DATE OF CALIBRATION : 11 June 2024

ENVIRONMENT CONDITIONS :

Temperature : $(25 \pm 2) ^\circ\text{C}$ Relative Humidity : $(55 \pm 15) \% \text{RH}$

PROCEDURE USED :

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

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

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

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd.
Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd.
Certificate No. 07-0050/24, Due Date 13 May 2025.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand)
Certificate No. AV-4052-23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24059620

F3-011-05/12-23

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เอกสารไม่ควบคุม



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok, 10230
Tel: 02-578-0353-4 Fax: 02-578-2672 www.cali-lab.com E-mail: sale@cali-lab.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.380	0.297	+0.003	1.9
0.4	50 Hz		0.400	0.395	+0.005	1.6
0.5	50 Hz		0.500	0.493	+0.007	1.6
0.6	50 Hz		0.600	0.591	+0.009	2.5
0.7	50 Hz		0.700	0.690	+0.010	2.5
0.3	100 Hz	peak	0.300	0.301	-0.001	1.9
0.4	100 Hz		0.400	0.402	-0.002	1.6
0.5	100 Hz		0.500	0.503	-0.003	1.6
0.6	100 Hz		0.600	0.604	-0.004	2.5
0.7	100 Hz		0.700	0.704	-0.004	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.003	-0.003	1.8
4	50 Hz		4.000	4.008	-0.008	1.8
5	50 Hz		5.000	5.016	-0.016	1.8
6	50 Hz		6.000	6.029	-0.029	1.8
7	50 Hz		7.000	7.036	-0.036	1.8
*3	100 Hz	peak	3.000	3.009	-0.009	1.6
*4	100 Hz		4.000	4.018	-0.018	1.6
*5	100 Hz		5.000	5.023	-0.023	1.6
*6	100 Hz		6.000	6.031	-0.031	1.5
*7	100 Hz		7.000	7.049	-0.049	1.5

Certificate No. Q24059620

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เอกสารไม่ควบคุม





CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukul 29 Yaek 4, Prasert Manukul Rd., Ladphrao, Bangkok 10230
Tel. 02-679-0353-4 Fax: 02-679-2672 www.cal-lab.com E-mail: sale@cal-lab.com



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukul 29 Yaek 4, Prasert Manukul Rd., Ladphrao, Bangkok 10230
Tel. 02-679-0353-4 Fax: 02-679-2672 www.cal-lab.com E-mail: sale@cal-lab.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.060	0.000	1.8
0.07	50 Hz		0.070	0.071	-0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.061	-0.001	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 87

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

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

End of Certificate

Certificate No. Q24059620

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CALIBRATION LABORATORY Co., LTD.

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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-679-0353-4 Fax: 02-679-2672 www.cal-lab.com E-mail: sale@cal-lab.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13206/UM13206
DATE OF CALIBRATION : 07 November 2023

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

The calibration was performed by using Digital Multimeter, Programmable Timer/Counter and Vibration Calibrator.

Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Vibration Calibrator, The Modal Shop Model 9110D S/N. 11424.
- Digital Multimeter, Hewlett Packard Model 34401A S/N. 3146A75935.
- Programmable Timer/Counter, Philips Model PM6680B S/N. SM607101.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0030-23, Due Date 26 June 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. EE-0136-22, Due Date 11 November 2023.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0043/23, Due Date 12 April 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95%. It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-402 M:2022)".

Certificate No. Q23122681

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เอกสารไม่ควบคุม



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13206/UM13206
CLID. NO. : 251900276
JOB CONTROL NO. : 231106122681

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

DATE OF RECEIVED : 06 November 2023

DATE OF ISSUED : 09 November 2023

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

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yoisontorn
Authorized Signatory
09 November 2023

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

Certificate No. Q23122681

F3-011-04/01-12

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CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2872 www.ccl-laboratory.com E-mail:sale@ccl-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.7
0.04	50 Hz		0.040	0.040	0.000	2.4
0.05	50 Hz		0.050	0.050	0.000	2.2
0.06	50 Hz		0.060	0.060	0.000	2.1
0.07	50 Hz		0.070	0.071	-0.001	2.1
0.03	100 Hz	peak	0.030	0.030	0.000	2.7
0.04	100 Hz		0.040	0.040	0.000	2.4
0.05	100 Hz		0.050	0.050	0.000	2.2
0.06	100 Hz		0.060	0.060	0.000	2.1
0.07	100 Hz		0.070	0.071	-0.001	2.1

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 009 Page 1,2 of 59

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

End of Certificate

Certificate No. Q23122681

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CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2872 www.ccl-laboratory.com E-mail:sale@ccl-laboratory.com



CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13368/UM13368 [UAE.EFM.053/2561]
CLID. NO. : 251900391
JOB CONTROL NO. : 240515050332
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 15 May 2024

DATE OF ISSUED : 21 May 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsoontorn
Authorized Signatory
21 May 2024

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

Certificate No. Q24050332

F3-011-05/12-23

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CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax: 02-578-2872 www.ccl-laboratory.com E-mail:sale@ccl-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2501/721A2901
SERIAL NO. : UM13368/UM13368 [UAE.EFM.053/2561]
DATE OF CALIBRATION : 17 May 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

REFERENCE STANDARD USED :

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

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0159/23, Due Date 04 December 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0052-23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k=2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.
It has been evaluated according to the "Evaluation of the Uncertainty of Measurement in Calibration (EA-4/02 M:2022)"

Certificate No. Q24050332

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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax: 02-578-2872 www.ccl-laboratory.com E-mail:sale@ccl-laboratory.com



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.300	0.000	1.9
0.4	50 Hz		0.400	0.400	0.000	1.6
0.5	50 Hz		0.500	0.501	-0.001	1.6
0.6	50 Hz		0.600	0.601	-0.001	2.5
0.7	50 Hz		0.700	0.702	-0.002	2.5
0.3	100 Hz	peak	0.300	0.300	0.000	1.9
0.4	100 Hz		0.400	0.400	0.000	1.6
0.5	100 Hz		0.500	0.501	-0.001	1.6
0.6	100 Hz		0.600	0.601	-0.001	2.5
0.7	100 Hz		0.700	0.702	-0.002	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	2.998	+0.002	1.8
4	50 Hz		4.000	3.987	+0.013	1.8
5	50 Hz		5.000	4.982	+0.018	1.8
6	50 Hz		6.000	5.977	+0.023	1.8
7	50 Hz		7.000	6.965	+0.035	1.8
*3	100 Hz	peak	3.000	2.993	+0.007	1.6
*4	100 Hz		4.000	3.987	+0.013	1.6
*5	100 Hz		5.000	4.975	+0.025	1.6
*6	100 Hz		6.000	5.966	+0.034	1.5
*7	100 Hz		7.000	6.954	+0.046	1.5

Certificate No. Q24050332

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CALIBRATION LABORATORY Co., LTD.

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



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.060	0.000	1.8
0.07	50 Hz		0.070	0.069	+0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.059	+0.001	1.8
0.07	100 Hz		0.070	0.069	+0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

End of Certificate

Certificate No. Q24050332

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เอกสารไม่ควบคุม



gclidcalibration

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11056/UM11056
CLID. NO. : 252000389
JOB CONTROL NO. : 240406037351
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 06 April 2024

DATE OF ISSUED : 10 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Suwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsontorn
Authorized Signatory
10 April 2024

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

Certificate No. Q24037351

F3-011-05/12-23

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210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrao, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cali-laboratory.com E-mail: sale@cal-laboratory.com



REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11056/UM11056
DATE OF CALIBRATION : 08 April 2024

ENVIRONMENT CONDITIONS :

Temperature : (25 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

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

The calibration was performed by using Digital Multimeter, Universal Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

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

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0159/23, Due Date 04 December 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0055-23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

It has been evaluated according to the "Evaluation of the Uncertainty of Measurement (EA-402 M:2022)"

Certificate No. Q24037351

F3-011-05/12-23

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CALIBRATION LABORATORY Co., LTD.

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



CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.302	-0.002	1.9
0.4	50 Hz		0.400	0.404	-0.004	1.6
0.5	50 Hz		0.500	0.505	-0.005	1.6
0.6	50 Hz		0.600	0.607	-0.007	2.5
0.7	50 Hz		0.700	0.708	-0.008	2.5
0.3	100 Hz	peak	0.300	0.302	-0.002	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.6
0.5	100 Hz		0.500	0.505	-0.005	1.6
0.6	100 Hz		0.600	0.607	-0.007	2.5
0.7	100 Hz		0.700	0.708	-0.008	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.048	-0.048	1.8
4	50 Hz		4.000	4.058	-0.058	1.8
5	50 Hz		5.000	5.066	-0.066	1.8
6	50 Hz		6.000	6.079	-0.079	1.8
7	50 Hz		7.000	7.089	-0.089	1.8
*3	100 Hz	peak	3.000	3.033	-0.033	1.6
*4	100 Hz		4.000	4.045	-0.045	1.6
*5	100 Hz		5.000	5.056	-0.056	1.6
*6	100 Hz		6.000	6.067	-0.067	1.5
*7	100 Hz		7.000	7.079	-0.079	1.5

Certificate No. Q24037351

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CALIBRATION LABORATORY Co., LTD.

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Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-lab-thailand.com E-mail: sales@cal-lab-thailand.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.061	-0.001	1.8
0.07	50 Hz		0.070	0.071	-0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.061	-0.001	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

Certificate No. Q24037351

F3-011-05/12-23

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gdcclab

CERTIFICATE OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11059/UM11059
CLID. NO. : 252000388
JOB CONTROL NO. : 240406037352
CALIBRATION SERVICE : ☒ IN-LABORATORY ☐ ON-SITE

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

DATE OF RECEIVED : 06 April 2024

DATE OF ISSUED : 10 April 2024

The report of calibration shall not be reproduced except in full without approval of the Calibration Laboratory Co., Ltd.

Calibrated By : Surwit Phuanbusabong
Calibration Engineer



Approved By : Mongkol Yotsotorn
Authorized Signatory
10 April 2024

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

Certificate No. Q24037352

F3-011-05/12-23

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gdcclab



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrae, Bangkok 10230
Tel. 02-578-0353-4 Fax. 02-578-2672 www.cal-lab-thailand.com E-mail: sales@cal-lab-thailand.com



CALIBRATION LABORATORY Co., LTD.

210-11,14,55 Soi Prasert Manukit 29 Yaek 4, Prasert Manukit Rd., Ladphrae, Bangkok 10230
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REPORT OF CALIBRATION

FOR

NOMENCLATURE : VIBRATION METER
MANUFACTURER : INSTANTEL
MODEL / TYPE : 721A2601/721A3301
SERIAL NO. : UM11059/UM11059
DATE OF CALIBRATION : 08 April 2024

ENVIRONMENT CONDITIONS :

Temperature : (23 ± 2) °C Relative Humidity : (55 ± 15) %RH

PROCEDURE USED :

This instrument was used in accordance with procedure No. CLC-CPEE-08 based on ISO 16063-21 as calibration guideline.

The calibration was performed by using Digital Multimeter, Universal Counter,

Accelerometer and Measuring Amplifier which maintained by the Calibration Laboratory Co., Ltd.

REFERENCE STANDARD USED :

- Digital Multimeter, Wavetek Model 1281 S/N. 29320.
- Universal Counter, Hewlett Packard Model 5315A S/N. 2448A13942.
- Accelerometer with Measuring Amplifier, Brüel & Kjær Model 8305, 2525 S/N. 397018, 2434988.

TRACEABILITY :

- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 05-0316/23, Due Date 21 July 2025.
- The measurements are traceable to International System of Units (SI), through Aeronautical Radio of Thailand Ltd. Certificate No. 07-0159/23, Due Date 04 December 2024.
- The measurements are traceable to International System of Units (SI), through National Institute of Metrology (Thailand) Certificate No. AV-0052/23, Due Date 26 September 2024.

UNCERTAINTY :

The reported expanded uncertainty of measurement is stated as the standard uncertainty of measurement multiplied by the coverage factor $k = 2.00$ which for a normal distribution corresponds to a coverage probability of approximately 95 %.

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

Certificate No. Q24037352

F3-011-05/12-23

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CONDITION OF CALIBRATION ITEM : RECEIVED IN GOOD OPERATIONAL CONDITION

MEASUREMENT RESULTS : (X) without adjustment () adjustment

CALIBRATION DATA

1. ACCELERATION RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(g)	(frequency)		(g)	(g)	(g)	± (% of rdg.)
0.3	50 Hz	peak	0.300	0.303	-0.003	1.9
0.4	50 Hz		0.400	0.404	-0.004	1.6
0.5	50 Hz		0.500	0.505	-0.005	1.6
0.6	50 Hz		0.600	0.606	-0.006	2.5
0.7	50 Hz		0.700	0.708	-0.008	2.5
0.3	100 Hz	peak	0.300	0.302	-0.002	1.9
0.4	100 Hz		0.400	0.403	-0.003	1.6
0.5	100 Hz		0.500	0.504	-0.004	1.6
0.6	100 Hz		0.600	0.607	-0.007	2.5
0.7	100 Hz		0.700	0.709	-0.009	2.5

2. VELOCITY RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm/s)	(frequency)		(mm/s)	(mm/s)	(mm/s)	± (% of rdg.)
3	50 Hz	peak	3.000	3.035	-0.035	1.8
4	50 Hz		4.000	4.041	-0.041	1.8
5	50 Hz		5.000	5.056	-0.056	1.8
6	50 Hz		6.000	6.068	-0.068	1.8
7	50 Hz		7.000	7.071	-0.071	1.8
*3	100 Hz	peak	3.000	3.046	-0.046	1.6
*4	100 Hz		4.000	4.051	-0.051	1.6
*5	100 Hz		5.000	5.063	-0.063	1.6
*6	100 Hz		6.000	6.072	-0.072	1.5
*7	100 Hz		7.000	7.088	-0.088	1.5

Certificate No. Q24037352

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CALIBRATION LABORATORY CO., LTD.

210-11, 14, 55 Soi Phrasert Manuk 29 Yae 4, Phrasert Manuk Rd., Lumpini, Bangkok 10230
Tel: 02-678-0353-4 Fax: 02-678-2672 www.ccl-laboratory.com E-mail: info@cal-laboratory.com



CALIBRATION DATA

3. DISPLACEMENT RESULT

Test point		Mode	STD Reading	DUC Reading	Correction	Uncertainty
(mm)	(frequency)		(mm)	(mm)	(mm)	± (% of rdg.)
0.03	50 Hz	peak	0.030	0.030	0.000	2.5
0.04	50 Hz		0.040	0.040	0.000	2.1
0.05	50 Hz		0.050	0.050	0.000	1.9
0.06	50 Hz		0.060	0.060	0.000	1.8
0.07	50 Hz		0.070	0.071	-0.001	1.8
0.03	100 Hz	peak	0.030	0.030	0.000	2.5
0.04	100 Hz		0.040	0.040	0.000	2.1
0.05	100 Hz		0.050	0.050	0.000	1.9
0.06	100 Hz		0.060	0.061	-0.001	1.8
0.07	100 Hz		0.070	0.071	-0.001	1.8

Note: The Scope of Accredited ANAB Certificate No. ACDM-2814 Version 012 Page 1,2 of 67

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

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

End of Certificate

Certificate No. Q24037352

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@calibration

INNOVATIVE INSTRUMENT CALIBRATION LAB
INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Certificate No : 24-ACT-077

Request No : Req-2024-1138

Sound pressure level

Calibration Results : Without Adjustment

Calibration Range (dB)	Without Adjustment (dB)		Adjustment (dB)		Uncertainty (± dB)	Acceptance limit Class 1 (± dB)
	Measured	Deviated value	Measured	Deviated value		
94 dB / 1000 Hz	93.83	-0.17	-	-	0.13	0.25
114 dB / 1000 Hz	113.80	-0.20	-	-	0.13	0.25

Frequency of Sound pressure level

Calibration Range (Hz)	Without Adjustment		Adjustment		Uncertainty (± %)	Acceptance limit Class 1 (± %)
	Measured (Hz)	Deviated value	Measured (Hz)	Deviated value		
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 (%)	Deviated value	Measured (%)	Deviated value		
94 dB / 1000 Hz	0.09	-	-	-	0.40	2.5
114 dB / 1000 Hz	0.28	-	-	-	0.40	2.5

Note :

Function	Maximum-permitted Uncertainty of measurement
Sound pressure level	0.15 dB
Frequency	0.20%
Total distortion+noise	0.50%

*Acceptance limit was IEC60942:2017 Class 1

*The calibration results exclude the calibration pressure correction

*The calibration results exclude the microphone volume correction

End of Calibration

เอกสารไม่ควบคุม

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

FM-708-ACT-02 Rev.01 Issue date:8/8/23

INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING

Certificate No : 24-ACT-077

CONSULTANT CO.,LTD.

Request No : Req-2024-1138

Address : 81 Soi Udomsak 41, Sukhumvit Road, BANGCHAK, Prakanong,
Bangkok 10260

Unit Under Calibration Details

Measurement item : Acoustic Calibrator

Class : 1

Manufacturer : SVANTEK

Range : 94 , 114 dB / 1000 Hz

Model : SV 35A

Instrument Status : Used

Serial Number : 73246

ID : UAE.EFM.104/2561

Calibration Environment and Details

Temperature : (23 ± 2 °C)

Humidity : (50 ± 20 %RH)

Barometric Pressure : (1013 ± 10.0 hPa)

Received Date : 23 May 2024

Calibration Date : 30 May 2024

Location of Calibration : LAB 1 Acoustic

Calibration Procedure : In-house method CP-ACT-02 based on IEC 60942:2017 Electroacoustics - Sound calibrators

Reference Standard	Model	Serial Number	Traceable	Due Calibration
Sound Calibrator	SV 35A	58079	EEI	31 May 2024
THD Multimeter	2015	1047765	NIMT	16 January 2025

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 Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 30 May 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the laboratory.
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FM-708-ACT-02 Rev.01 Issue date:8/8/23

INNOVATIVE INSTRUMENT CALIBRATION LAB

INNOVATIVE INSTRUMENT CO., LTD. HEAD OFFICE
7139 MOO 13, SOI SUTINAKORN 11 TAMBON BANG KHAO,
AMPHOE BANG PHU SAMUT PRAKAN PROVINCE 10540 THAILAND
TEL: 1660-2116-5860-1 FAX: 1660-2116-7140



Certificate of Calibration

Customer

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

Certificate No : 24-SLM-229

Address : 81 Soi Udomsak 41, Sukhumvit Road, BANGCHAK, Prakanong, Bangkok
10260

Request No : Req-2024-1448

Unit Under Calibration Details

Measurement item : Sound Level Meter

Microphone Class : 2

Manufacturer : Larson Davis

Microphone Model : 375B02

Model : LX72

Microphone S/N : 11792

Serial Number : 0065372

Preamplifier Model : PRMLA12B

ID : UAE.EFM.037/2563

Preamplifier S/N : 056132

Resolution : 0.1 dB

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 : 1 July 2024

Calibrated Date : 9 July 2024

Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-1 : 2013 Electroacoustics - Sound level meters - Part 1: Periodic tests

Location of Calibration : Lab-Acoustic

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	HFAR00234	26 July 2024	ISI
Audio Generator	Brüel	5120B01	131	9 October 2024	WK Electric

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 Luangart
Service Calibration Engineer

Approved By :

Mr. Pacit Mathavorn
Calibration Engineer Supervisor

Issue Date : 9 July 2024

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

FM-708-ACT-02 Rev.01 Issue date:8/8/23

Certificate No : 24-SLM-229

Request No : Req-2024-1448

1. Indication at the calibration check frequency

UUC Setting FAST / A / 37-139	Nominal Level (dB)	Before Adjust		After Adjust		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
1000 Hz (114 dB)	113.76	114.7	0.94	113.8	+0.04	0.20	0.30	Pass

Note: Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 33A, SN: 58078

2. Self-generated noise, Microphone installed

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY ($\pm$ dB)
UUC Weighting		
A	32.0	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting FAST / 37-139	Measured (dB)	UNCERTAINTY ($\pm$ dB)
UUC Weighting		
A	31.8	0.10
C	31.7	0.10
Z	31.9	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting						
125 Hz	0.1	0.2	0.1	0.80	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.80	1.0	Pass
4000 Hz	0.1	0.1	0.4	0.80	1.0	Pass
3000 Hz	0.1	0.1	0.5	0.70	1.0	Pass

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

File: 108-36-01 Rev 01 Issue Date: 5/6/24

Certificate No : 24-SLM-229

Request No : Req-2024-1448

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
	A (dB)	C (dB)	Z (dB)			
STD Setting						
63 Hz	-0.1	0.0	0.0	0.20	2.0	Pass
125 Hz	-0.1	0.0	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.0	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.0	0.1	0.0		1.0	Pass
4000 Hz	0.0	0.0	0.0		1.0	Pass
8000 Hz	0.0	0.0	0.1		1.0	Pass
16000 Hz	0.0	0.0	0.0		<5.1NF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD REF (dB)	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
UUC Weighting						
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting 37-139 / A	STD REF (dB)	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
UUC Time Response						
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
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File: 108-36-01 Rev 01 Issue Date: 5/6/24

Certificate No : 24-SLM-229

Request No : Req-2024-1448

7. Long Term Stability

UUC Setting FAST / A / 37-139	Measured UUC (dB)	UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
STD Setting				
Initial	114.0	0.10	0.30	Pass
Final	114.0			
Deviated	0.0			

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated			UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
	REF (dB)	UUC (dB)	ERR (dB)			
STD dB						
139.00	139	139.0	0.0	0.30	1.1	Pass
134.00	134	134.0	0.0		1.1	Pass
129.00	129	129.0	0.0		1.1	Pass
124.00	124	124.0	0.0		1.1	Pass
119.00	119	119.0	0.0		1.1	Pass
114.00	114	114.0	0.0		1.1	Pass
109.00	109	109.0	0.0		1.1	Pass
104.00	104	104.0	0.0		1.1	Pass
99.00	99	99.0	0.0		1.1	Pass
94.00	94	93.6	-0.4		1.1	Pass
89.00	89	88.6	-0.4		1.1	Pass
84.00	84	83.6	-0.4		1.1	Pass
79.00	79	78.6	-0.4		1.1	Pass
74.00	74	73.6	-0.4		1.1	Pass
69.00	69	68.6	-0.4		1.1	Pass
64.00	64	63.6	-0.4		1.1	Pass
59.00	59	58.6	-0.4		1.1	Pass
54.00	54	53.6	-0.4		1.1	Pass
49.00	49	48.7	-0.3		1.1	Pass
44.00	44	43.9	-0.1		1.1	Pass
39.00	39	38.5	-0.5		1.1	Pass
34.00	34	34.9	0.9		1.1	Pass

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

File: 108-36-01 Rev 01 Issue Date: 5/6/24

Certificate No : 24-SLM-229

Request No : Req-2024-1448

9. Level linearity including the level range control

UUC Setting FAST / A	STD REF (dB)	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
UUC Range						
37-139	39.10	39.6	0.5	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting A / 37-139	STD Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
			UUC (dB)	ERR (dB)			
UUC Time Response							
Fast	200	133.0	123.0	0.0	0.20	1.0	Pass
	2	100.0	117.8	-0.1		+1.0, -2.5	Pass
	0.25	100.0	106.8	-0.2		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1		1.0	Pass
	2	100.0	100.9	-0.1		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	100.0	100.1	+0.1		+1.0, -2.5	Pass
	0.25	100.0	100.0	0.0		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting FAST / C / 95-142	Anticipated REF (dB)	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
STD Setting						
Complete cycle	137.4	136.8	-0.60	0.20	1.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

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

File: 108-36-01 Rev 01 Issue Date: 5/6/24

Certificate No : 24-SLM-229
Request No : Req-2024-1448

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	$(\pm \text{dB})$	$(\pm \text{dB})$	Pass
STD Setting	(dB)			
Positive one-half cycle	140.7			
Negative one-half cycle	140.7			
Deviated	0.0			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	$(\pm \text{dB})$	$(\pm \text{dB})$	Pass
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Deviated	0.0			

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Time burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

Acceptance limit and Maximum permitted Uncertainty was REF 61872-5:2013

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

Certificate No : 24-SLM-229
Request No : Req-2024-1448

Decision Rule for Statements of Conformity

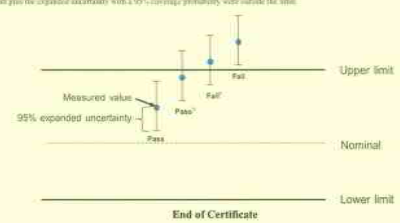
The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-G8:09/2019, Guidelines on the Reporting of Compliance with Specification as following 3ig and statement.

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability, were within the limit.

Pass⁺ - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail⁺ - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability, were outside the limit.



End of Certificate

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

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-232
Request No : Req-2024-1451

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LX72
Serial Number : 0005341
ID : UAE EFM1082583
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375B02
Microphone S/N : J1793
Preamplifier Model : PRMLsT2B
Preamplifier S/N : 056133
Instrument Status : Used

Calibration Environment and Details

Temperature : 25 °C ± 2 °C
Humidity : 50 %RH ± 20 %RH
Barometric Pressure : 1013 hPa ± 10 hPa
Received Date : 1 July 2024
Calibrated Date : 10 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic test
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	110273	20 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	24 July 2024	TSI
Audio Generator	Srnatik	Srnat401	131	8 October 2024	WK Electric

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. Noppodon Luangrit
Service Calibration Engineer

Approved By :
Mr. Pavin Mathavorn
Calibration Engineer Supervisor
Issue Date : 10 July 2024

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

Certificate No : 24-SLM-232
Request No : Req-2024-1451

1. Indication at the calibration check frequency

UUC Setting	Nominal Level	Before Adjust		After Adjust		UNCERTAINTY ($\pm$ dB)	Acceptance Limit	Result
FAST / A / 37-139		UUC (dB)	ERR (dB)	UUC (dB)	ERR (dB)			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)			
1000 Hz 114 dB	113.76	114.3	0.54	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A-SN. 59079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	($\pm \text{dB}$)
UUC Weighting	(dB)	($\pm \text{dB}$)
A	29.7	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	($\pm \text{dB}$)
UUC Weighting	(dB)	($\pm \text{dB}$)
A	29.4	0.10
C	29.0	0.10
Z	33.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A C Z (dB)	($\pm \text{dB}$)	($\pm \text{dB}$)	
STD Setting	(dB)	($\pm \text{dB}$)	($\pm \text{dB}$)	
125 Hz	0.0 0.1 0.1	0.60	1.5	Pass
1000 Hz	0.0 0.0 0.0	0.60	1.0	Pass
4000 Hz	0.6 0.5 0.6	0.60	3.0	Pass
8000 Hz	1.0 0.9 1.0	0.70	5.0	Pass

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เอกสารไม่ควบคุม

Certificate No. : 24-SLM-232
Request No. : Req/2024-1451

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting FAST / 37-139	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
	STD Setting	A (dB)	C (dB)	Z (dB)		
37-139	63 Hz	-0.2	-0.1	-0.1	0.20	Pass
	125 Hz	-0.1	0.0	-0.1		Pass
	250 Hz	-0.1	0.0	-0.1		Pass
	500 Hz	-0.1	0.0	-0.1		Pass
	1000 Hz	0.0	0.0	-0.1		Pass
	2000 Hz	0.0	0.0	0.0		Pass
	4000 Hz	0.0	0.0	0.0		Pass
	8000 Hz	-0.1	-0.1	0.0		Pass
	16000 Hz	-0.1	-0.1	-0.1		Pass
						Pass

6. Frequency and time weightings at 1kHz

UUC Setting FAST / 37-139	STD REF	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
UUC Weighting	A	114.00	114.0	0.0	0.20	Pass
	C	114.00	114.0	0.0		Pass
	Z	114.00	114.0	0.0		Pass

UUC Setting 37-139 / A	STD REF	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
UUC Time Response	Fast	114.00	114.0	0.0	0.20	Pass
	Slow	114.00	114.0	0.0		Pass
	Lsq	114.00	114.0	0.0		Pass
						Pass

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File Path: 06-36101 Rev.00 Issue Date: 24-02-24

Certificate No. : 24-SLM-232
Request No. : Req/2024-1451

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	($\pm$ dB)	($\pm$ dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting FAST / A / 37-139	Anticipated REF (dB)	Deviation		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
STD dB	139.00	139	139.0	0.0	0.30	Pass
	134.00	134	134.0	0.0		Pass
	129.00	129	129.0	0.0		Pass
	124.00	124	124.0	0.0		Pass
	119.00	119	119.0	0.0		Pass
	114.00	114	114.0	0.0		Pass
	109.00	109	109.0	0.0		Pass
	104.00	104	104.0	0.0		Pass
	99.00	99	99.0	0.0		Pass
	94.00	94	94.0	0.0		Pass
	89.00	89	89.0	0.0		Pass
	84.00	84	84.0	0.0		Pass
	79.00	79	79.0	0.0		Pass
	74.00	74	74.0	0.0		Pass
	69.00	69	69.0	0.0		Pass
	64.00	64	64.0	0.0		Pass
	59.00	59	59.0	0.0		Pass
	54.00	54	54.0	0.0		Pass
	49.00	49	49.0	0.1		Pass
	44.00	44	44.2	0.2		Pass
	39.00	39	39.5	0.3		Pass

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เอกสารไม่ควบคุม

File Path: 06-36101 Rev.00 Issue Date: 24-02-24

Certificate No. : 24-SLM-232
Request No. : Req/2024-1451

9. Level linearity including the level range control

UUC Setting FAST / A	STD REF	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
37-139	44.20	44.3	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting A / 37-139	Toneburst (ms)	Anticipated Ref (dB)	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
			UUC (dB)	ERR (dB)			
Fast	200	135.0	135.0	0.0	0.20	1.0	Pass
	2	118.0	117.8	-0.2		+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2	0.20	1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
	2	109.0	109.0	0.0		+1.0, -2.5	Pass
SEL	0.25	100.0	99.7	-0.3	0.20	+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting FAST / C / 95-142	Anticipated REF	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC (dB)	ERR (dB)			
STD Setting	137.4	136.8	-0.60	0.20	3.0	Pass
	Complete cycle	136.4	-1.00		2.0	Pass
	Positive half cycle	136.2	-1.20		2.0	Pass
	Negative half cycle	136.2	-1.20		2.0	Pass

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

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File Path: 06-36101 Rev.00 Issue Date: 24-02-24

Certificate No. : 24-SLM-232
Request No. : Req/2024-1451

12. Overload indication

UUC Setting FAST / A / 37-139	Measured UUC (dB)	UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
STD Setting	Positive one-half cycle	143.2		
	Negative one-half cycle	143.3		
Deviated	-0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-129	UUC (dB)	($\pm$ dB)	($\pm$ dB)	
STD Setting				
Initial	138.0			
Final	138.0			
Deviation	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at 4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.15 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

Acceptance Limit and Maximum-permitted Uncertainty was IEC 61012-5:2013

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File Path: 06-36101 Rev.00 Issue Date: 24-02-24

Certificate No : 24-SLM-232
Request No : Req-2024-1451

Decision Rule for Statements of Conformity

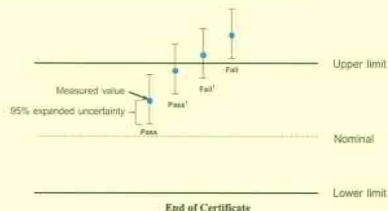
The standard decision rule employed for the statements of conformity in each calibration result will be applied using ILAC-G8:2019. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements

Pass - The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass^N - The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail^N - The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail - The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



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 provider. เอกสารไม่ควบคุม

ISO 17025:2017 Rev.04 Issue date 2/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsak 41, Sukhumvit Road, Bangchak, Prachinwong, Bangkok 10268

Certificate No : 24-SLM-235
Request No : Req-2024-1454

Unit Under Calibration Details

Measurement Item : Sound Level Meter
Microphone Class : 2
Manufacturer : Larson Davis
Microphone Model : 375B02
Model : LA72
Microphone S/N : 11798
Serial Number : 0065346
Preamplifier Model : PRA01X128
ID : UAEFEM0452563
Preamplifier S/N : 056138
Resolution : 0.1 dB
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 : 3 July 2024
Calibrated Date : 09 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab-Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multifrequency Calibrator	Quest	Quest-cal	EF/000234	26 July 2024	JIS
Audio Generator	Sony	SonyBH	135	9 October 2024	WJ Electric

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 Luangrat
Service Calibration Engineer

Approved By :
Mr. Pate Maitavorn
Calibration Engineer Supervisor
Issue Date : 10 July 2024

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ISO 17025:2017 Rev.04 Issue date 2/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	After Adjust	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	
1000 Hz 114 dB	113.76	115.3	1.54	113.8	-0.04	0.20

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTER, Model SV 35A, SN: 59079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	31.8	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	(± dB)
A	31.1	0.10
C	30.5	0.10
Z	35.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance	Result
FAST / 37-139	A	C	Z	
STD Setting	(dB)	(dB)	(dB)	(± dB)
125 Hz	0.0	0.1	0.1	0.60
1000 Hz	0.0	0.0	0.0	0.60
4000 Hz	1.1	1.1	1.1	0.60
8000 Hz	2.6	2.5	2.6	0.70

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ISO 17025:2017 Rev.04 Issue date 2/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)	
STD Setting	(dB)	(dB)	(dB)	(± dB)
63 Hz	-0.1	0.0	0.1	0.20
125 Hz	-0.1	0.0	0.0	1.5
250 Hz	-0.1	0.0	0.0	1.5
500 Hz	0.0	0.1	0.0	1.5
1000 Hz	0.0	0.0	0.0	1.0
2000 Hz	0.0	0.1	0.0	2.0
4000 Hz	0.0	-0.1	0.0	2.0
8000 Hz	-0.1	-0.1	0.0	5.0
16000 Hz	-0.1	-0.1	-0.1	<5. INF

6. Frequency and time weightings at 1 kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
FAST / 37-139	REF	UUC	ERR		
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.20	Pass
C	114.00	114.0	0.0	0.20	Pass
Z	114.00	114.0	0.0	0.20	Pass

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR		
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.10	Pass
Slow	114.00	114.0	0.0	0.10	Pass
Eq	114.00	114.0	0.0	0.10	Pass

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ISO 17025:2017 Rev.04 Issue date 2/6/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	($\pm$ dB)	($\pm$ dB)	
Initial	114.0			
Final	114.0			
Deviated	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	REF	UUC		Limit	
STD dB	(dB)	(dB)	(dB)	($\pm$ dB)	
130.00	139	139.0	0.0	1.1	Pass
134.00	134	134.0	0.0	1.1	Pass
129.00	129	129.0	0.0	1.1	Pass
124.00	124	124.0	0.0	1.1	Pass
119.00	119	119.0	0.0	1.1	Pass
114.00	114	114.0	0.0	1.1	Pass
109.00	109	109.0	0.0	1.1	Pass
104.00	104	104.0	0.0	1.1	Pass
99.00	99	99.0	0.0	1.1	Pass
94.00	94	94.0	0.0	1.1	Pass
89.00	89	89.0	0.0	1.1	Pass
84.00	84	84.0	0.0	1.1	Pass
79.00	79	79.0	0.0	1.1	Pass
74.00	74	74.0	0.0	1.1	Pass
69.00	69	69.0	0.0	1.1	Pass
64.00	64	64.0	0.0	1.1	Pass
59.00	59	59.0	0.0	1.1	Pass
54.00	54	54.0	0.0	1.1	Pass
49.00	49	49.0	0.1	1.1	Pass
44.00	44	44.2	0.2	1.1	Pass
43.00	43	43.3	0.3	1.1	Pass
42.00	42	42.3	0.3	1.1	Pass
41.00	41	41.4	0.4	1.1	Pass

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File No: 063601 Rev:04 Issue Date: 5/8/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

9. Level linearity including the level range control

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance	Result
FAST / A	REF	UUC		Limit	
UUC Range	(dB)	(dB)	(dB)	($\pm$ dB)	
37-139	46.40	46.5	0.1	1.1	Pass
	114	114.0	0.0	1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	($\pm$ dB)	
Fast	200	135.0	134.8	-0.2	1.0	Pass
	2	118.0	117.6	-0.4	+1.0, -2.5	Pass
	0.25	109.0	108.5	-0.5	+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2	1.0	Pass
	2	100.0	100.8	-0.2	+1.0, -5.0	Pass
	200	129.0	129.0	0.0	1.0	Pass
SEL	2	100.0	100.8	-0.2	+1.0, -2.5	Pass
	0.25	100.0	99.7	-0.3	+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured	UNCERTAINTY	Acceptance	Result
FAST / C / 95-142	REF	UUC		Limit	
STD Setting	(dB)	(dB)	(dB)	($\pm$ dB)	
Complete cycle	137.4	136.8	-0.60	3.0	Pass
Positive half cycle	136.4	136.2	-0.20	2.0	Pass
Negative half cycle	136.4	136.2	-0.20	2.0	Pass

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File No: 063601 Rev:04 Issue Date: 5/8/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	($\pm$ dB)	($\pm$ dB)	
Positive one-half cycle	145.4			
Negative one-half cycle	145.3			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance	Result
FAST / A / 37-139	UUC		Limit	
STD Setting	(dB)	($\pm$ dB)	($\pm$ dB)	
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise. Microphone installed	Not applicable
3. Self-generated noise. Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at 4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings. Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

* Acceptance limit and Maximum-permitted Uncertainty was IEC 61073 (2004)

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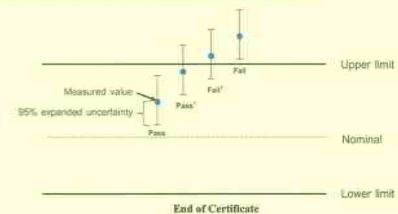
File No: 063601 Rev:04 Issue Date: 5/8/24

Certificate No : 24-SLM-235
Request No : Req-2024-1454

Decision Rule for Statements of Conformity

The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:19/2019. Guidelines on the Reporting of Conformance with Specification as following Fig. and statement.

- Pass = The measurement result plus the expanded uncertainty, with a 95% coverage probability, were within the limit.
- Pass^u = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.
- Fail^u = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.
- Fail = The measurement result plus the expanded uncertainty, with a 95% coverage probability, were outside the limit.



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File No: 063601 Rev:04 Issue Date: 5/8/24

Certificate of Calibration

Customer

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

Certificate No : 24-SLM-233
Request No : Req-2024-1452

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LxT2
Serial Number : 0096888
ID : UAE-IFM1382563
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 33789
Preamplifier Model : PRMLX72C
Preamplifier S/N : 071588
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 : 1 July 2024
Calibrated Date : 10 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3:2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	SN	Due calibration	Traceability
Standard Microphone	GRAS	40AN	105275	20 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	FFA000234	26 July 2024	TSI
Acoustic Generator	Syntech	Syntech	131	8 October 2024	WK Electric

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 Luangnue
Service Calibration Engineer

Approved By :
Mr. Pachi Mahavong
Calibration Engineer Supervisor
Issue Date : 10 July 2024

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

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Certificate No : 24-SLM-233
Request No : Req-2024-1452

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust	After Adjust	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	Level	UUC	ERR	UUC	ERR	
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	
1000 Hz 114 dB	113.76	114.6	0.84	113.8	-0.04	0.20

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 58078

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	29.3	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	(± dB)
UUC Weighting	(dB)	(± dB)
A	29.8	0.10
C	28.7	0.10
Z	33.1	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A (dB)	C (dB)	Z (dB)	(± dB)	(± dB)	
STD Setting	(dB)	(dB)	(dB)			
125 Hz	-0.1	0.1	0.0	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	0.7	0.7	0.7	0.60	3.0	Pass
8000 Hz	0.9	0.9	1.0	0.70	5.0	Pass

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

เอกสารไม่ควบคุม

Certificate No : 24-SLM-233
Request No : Req-2024-1452

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY (± dB)	Acceptance Limit (± dB)	Result
	A (dB)	C (dB)	Z (dB)			
FAST / 27-139	Weighting Response curve			0.20		
STD Setting						
63 Hz	-0.1	0.0	0.0		2.0	Pass
125 Hz	-0.1	0.1	0.0		1.5	Pass
250 Hz	-0.1	0.0	0.0		1.5	Pass
500 Hz	0.0	0.1	0.0		1.5	Pass
1000 Hz	0.0	0.0	0.0		1.0	Pass
2000 Hz	0.1	0.1	0.0		2.0	Pass
4000 Hz	0.0	0.1	-0.1		2.0	Pass
8000 Hz	0.0	0.0	-0.1		5.0	Pass
16000 Hz	0.0	0.0	-0.1	+5, -INF	Pass	

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	REF	UUC	ERR	(± dB)	(± dB)
UUC Weighting	(dB)	(dB)	(dB)	(± dB)	(± dB)
A	114.00	114.0	0.0	0.20	Pass
C	114.00	114.0	0.0	0.20	Pass
Z	114.00	114.0	0.0	0.20	Pass

UUC Setting	STD	Measured	UNCERTAINTY	Acceptance Limit	Result
37-139 / A	REF	UUC	ERR	(± dB)	(± dB)
UUC Time Response	(dB)	(dB)	(dB)	(± dB)	(± dB)
Fast	114.00	114.0	0.0	0.10	Pass
Slow	114.00	114.0	0.0	0.10	Pass
Leq	114.00	114.0	0.0	0.10	Pass

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

เอกสารไม่ควบคุม

Certificate No : 24-SLM-233
Request No : Req-2024-1452

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	(± dB)
STD Setting	(dB)	(dB)	(dB)	(dB)
Initial	114.0			
Final	114.0			
Deviation	0.0	0.10	0.30	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	REF	UUC	ERR	(± dB)	(± dB)
STD dB	(dB)	(dB)	(dB)	(± dB)	(± dB)
120.00	119	119.0	0.0	1.1	Pass
134.00	134	134.0	0.0	1.1	Pass
129.00	129	129.0	0.0	1.1	Pass
124.00	124	124.0	0.0	1.1	Pass
119.00	119	119.0	0.0	1.1	Pass
114.00	114	114.0	0.0	1.1	Pass
109.00	109	109.0	0.0	1.1	Pass
104.00	104	104.0	0.0	1.1	Pass
99.00	99	99.0	-0.1	1.1	Pass
94.00	94	93.9	-0.1	1.1	Pass
89.00	89	89.0	-0.1	1.1	Pass
84.00	84	83.9	-0.1	1.1	Pass
79.00	79	78.9	-0.1	1.1	Pass
74.00	74	73.9	-0.1	1.1	Pass
69.00	69	68.9	-0.1	1.1	Pass
64.00	64	63.9	-0.1	1.1	Pass
59.00	59	58.9	-0.1	1.1	Pass
54.00	54	53.8	-0.1	1.1	Pass
49.00	49	48.0	-0.0	1.1	Pass
44.00	44	44.0	0.0	1.1	Pass
39.00	39	39.1	0.1	1.1	Pass

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

เอกสารไม่ควบคุม

Certificate No. : 24-SI-M-233
Request No. : Req-2024-1452

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance Limit	Result
		REF	UUC			
FAST / A	(dB)	(dB)	(dB)	(± dB)	(± dB)	
37-139	44.0	44.2	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
			Ref	UUC			
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.7	-0.3		+1.0, -2.5	Pass
	0.25	100.0	100.6	+0.6		+1.5, -5.0	Pass
Slow	200	128.6	128.5	-0.1	0.20	1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	108.9	-0.1	0.20	+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
		REF	UUC			
FAST / C / 95-142	(dB)	(dB)	(dB)	(± dB)	(± dB)	
STD Setting	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Complete cycle	137.4	136.6	-0.80	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

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

Certificate No. : 24-SI-M-233
Request No. : Req-2024-1452

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	(± dB)	(± dB)	
STD Setting	(dB)			
Positive one-half cycle	143.1			
Negative one-half cycle	143.0			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY (± dB)	Acceptance Limit	Result
FAST / A / 37-139	UUC (dB)		(± dB)	
STD Setting				
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at 4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.15 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

* Acceptance limit and Maximum permitted Uncertainty was IEC 61672-1:2013

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

Certificate No. : 24-SI-M-233
Request No. : Req-2024-1452

Decision Rule for Statements of Conformity

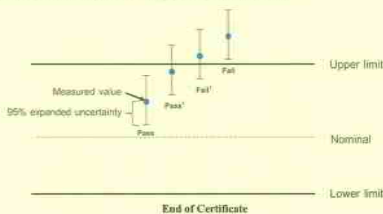
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-G8:2010. Guidelines on the Reporting of Compliance with Specification as following Fig. and statements.

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass* = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail* = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



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

Certificate of Calibration

Customer : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Name : R. Sri Udomsak 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No. : 24-SI-M-230
Request No. : Req-2024-1449

Unit Under Calibration Details

Measurement Item :	Sound Level Meter	Microphone Class : 2
Manufacturer :	Larsen Davis	Microphone Model : 375A04
Model :	LA72	Microphone S/N : 11782
Serial Number :	0066699	Preamplifier Model : P0ML47C
ID :	UAE-EFM-139/265	Preamplifier S/N : 071509
Resolution :	0.1 dB	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 :	1 July 2024
Calibrated Date :	10 July 2024
Calibration Procedure :	In-house method CP-SLM-01 based on IEC 61672-1:2013 Electroacoustics - Sound level meters - Part 1: Periodic tests
Location of Calibration :	Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188375	20 August 2024	GRAS
Multifrequency Calibrator	Quate	Quate-cal	EEA000234	26 July 2024	TSI
Audio Generator	Svanick	Svan401	131	8 October 2024	WK Electric

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. Pichit Muthavorn
Service Calibration Engineer

Approved By : Mr. Pichit Muthavorn
Calibration Engineer Supervisor
Issue Date : 18 July 2024

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

Certificate No : 24-SLM-230
Request No : Req-2024-1449

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance	Result
FAST / A / 37-139		UUC	ERR	UUC	ERR			
Calibrator Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	Limit	
1000 Hz 114 dB	113.76	112.9	-0.86	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 25A, SN: 58078

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	($\pm$ dB)
A	31.2	0.30

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139		
UUC Weighting	(dB)	($\pm$ dB)
A	31.8	0.30
C	30.5	0.30
Z	34.9	0.30

4. Acoustic signal test of frequency weightings (Without Windscreen)

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A C Z	($\pm$ dB)	($\pm$ dB)	
STD Setting	(dB) (dB) (dB)			
125 Hz	-0.0 0.1 0.1	0.60	1.5	Pass
3000 Hz	0.0 0.0 0.0	0.60	1.0	Pass
4000 Hz	0.2 0.2 0.2	0.60	3.0	Pass
8000 Hz	-0.1 0.0 0.0	0.70	5.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
316-708-94-04 Rev 04 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-SLM-230
Request No : Req-2024-1449

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency Weighting Response curve	UNCERTAINTY	Acceptance Limit	Result
FAST / 37-139	A C Z	($\pm$ dB)	($\pm$ dB)	
STD Setting	(dB) (dB) (dB)			
63 Hz	-0.1 0.0 0.0	0.20	2.0	Pass
125 Hz	-0.1 0.0 0.0		1.5	Pass
250 Hz	-0.1 0.0 0.0		1.5	Pass
500 Hz	0.0 0.0 0.0		1.5	Pass
1000 Hz	0.0 0.0 0.0		1.0	Pass
2000 Hz	0.0 0.1 0.0		2.0	Pass
4000 Hz	0.0 0.0 0.0		3.0	Pass
8000 Hz	0.0 0.0 0.0		5.0	Pass
10000 Hz	-0.1 -0.1 -0.1		>5, <NF	Pass

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
FAST / 37-139	REF	UUC	ERR		Limit	
UUC Weighting	(dB)	(dB)	(dB)	($\pm$ dB)	($\pm$ dB)	
A	114.00	114.0	0.0	0.20	0.20	Pass
C	114.00	114.0	0.0		0.20	Pass
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY	Acceptance	Result
37-139 / A	REF	UUC	ERR		Limit	
UUC Time Response	(dB)	(dB)	(dB)	($\pm$ dB)	($\pm$ dB)	
Fast	114.00	114.0	0.0	0.20	0.10	Pass
Slow	114.00	114.0	0.0		0.10	Pass
Log	114.00	114.0	0.0		0.10	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
316-708-94-04 Rev 04 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-SLM-230
Request No : Req-2024-1449

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	($\pm$ dB)	($\pm$ dB)	
STD Setting	(dB)			
Initial	114.0			
Final	114.0			
Deviated	0.0			
	0.0	0.10	0.20	Pass

8. Level linearity on the reference level range

UUC Setting	Anticipated	Deviation		UNCERTAINTY (± dB)	Acceptance	Result
FAST / A / 37-139	REF	UUC	ERR		Limit	
STD dB	(dB)	(dB)	(dB)		(± dB)	
139.00	139	139.0	0.0	0.30	1.0	Pass
134.00	134	134.0	0.0		1.0	Pass
129.00	129	129.0	0.0		1.0	Pass
124.00	124	124.0	0.0		1.0	Pass
119.00	119	119.0	0.0		1.0	Pass
114.00	114	114.0	0.0		1.0	Pass
109.00	109	109.0	0.0		1.0	Pass
104.00	104	104.0	0.0		1.0	Pass
99.00	99	99.0	0.0		1.0	Pass
94.00	94	94.0	0.0		1.0	Pass
89.00	89	89.0	0.0		1.0	Pass
84.00	84	84.0	0.0		1.0	Pass
79.00	79	79.0	0.0		1.0	Pass
74.00	74	74.0	0.0		1.0	Pass
69.00	69	69.0	0.0		1.0	Pass
64.00	64	64.0	0.0		1.0	Pass
59.00	59	59.0	0.0		1.0	Pass
54.00	54	54.0	0.0		1.0	Pass
49.00	49	49.0	0.0		1.0	Pass
44.00	44	44.0	0.0		1.0	Pass
39.00	39	39.0	0.0		1.0	Pass
34.00	34	34.0	0.0		1.0	Pass
29.00	29	29.0	0.0		1.0	Pass
24.00	24	24.0	0.0		1.0	Pass
19.00	19	19.0	0.0		1.0	Pass
14.00	14	14.0	0.0		1.0	Pass
9.00	9	9.0	0.0		1.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
316-708-94-04 Rev 04 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-SLM-230
Request No : Req-2024-1449

9. Level linearity including the level range control

UUC Setting	STD	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance	Result
FAST / A	REF	UUC	ERR		Limit	
UUC Range	(dB)	(dB)	(dB)		($\pm$ dB)	
37-139	46.20	46.3	0.1	0.30	1.1	Pass
	114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated	Measured		UNCERTAINTY	Acceptance	Result
A / 37-139	Toneburst	Ref	UUC	ERR		Limit	
UUC Time Response	(ms)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
Fast	200	135.0	134.9	-0.1	0.20	1.0	Pass
	2	118.0	117.9	-0.1		+1.0, -2.5	Pass
	0.25	100.0	100.8	+0.8		+1.5, -5.0	Pass
Slow	200	128.6	128.4	-0.2		1.0	Pass
	2	109.0	108.8	-0.2		+1.0, -5.0	Pass
	200	129.0	129.0	0.0		1.0	Pass
SEL	2	109.0	108.1	+0.1	0.20	+1.0, -2.5	Pass
	0.25	100.0	99.8	-0.2		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
FAST / C / 95-142	REF	UUC	ERR	(± dB)	(± dB)	Result
STD Setting	(dB)	(dB)	(dB)			
Complete cycle	137.4	136.7	-0.70			
Positive half cycle	136.4	136.2	-0.20			
Negative half cycle	136.4	136.2	-0.20	0.20	2.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
316-708-94-04 Rev 04 Issue date 5/6/24

เอกสารไม่ควบคุม

Certificate No : 24-SLM-230
Request No : Req-2024-1449

12. Overload indication

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	($\pm$ dB)	($\pm$ dB)	
STD Setting	(dB)			
Positive one-half cycle	145.0			
Negative one-half cycle	144.9			
Deviated	0.1	0.20	1.5	Pass

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139	UUC	($\pm$ dB)	($\pm$ dB)	
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Deviated	0.0	0.10	0.30	Pass

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at 4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1 kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
8. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

* Acceptance limit and Maximum permitted Uncertainty was (IEC 61672-1:2013)

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

File 100-1614-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-230
Request No : Req-2024-1449

Decision Rule for Statements of Conformity

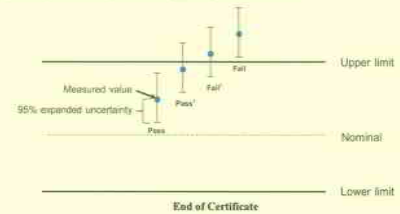
The standard decision rule employed for the statements of conformity to each calibration result will be applied using ILAC-GI-09:2018, Guidelines on the Reporting of Compliance with Specifications as following Fig. and statements

Pass = The measurement result plus the expanded uncertainty with a 95% coverage probability were within the limit.

Pass¹ = The measurement result was within the limit. However, a portion of the expanded uncertainty of measurement at 95% exceeds the limit.

Fail¹ = The measurement result was out of the limit. However, a portion of the expanded uncertainty of measurement at 95% is within the limit.

Fail = The measurement result plus the expanded uncertainty with a 95% coverage probability were outside the limit.



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

File 100-1614-01 Rev.04 Issue date 5/6/24

Certificate of Calibration

Customer

Name : UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address : 81 Soi Udomsuk 41, Sukhumvit Road, Bangkok, Prakanong, Bangkok 10260
Certificate No : 24-SLM-239
Request No : Req-2024-1458

Unit Under Calibration Details

Measurement item : Sound Level Meter
Manufacturer : Larson Davis
Model : LxT2
Serial Number : 0006756
ID : UAE.EFM.032/2566
Resolution : 0.1 dB
Microphone Class : 2
Microphone Model : 375A04
Microphone S/N : 346384
Preamplifier Model : PRMLX72C
Preamplifier S/N : 072885
Instrument Status : Used

Calibration Environment and Details

Temperature : 23.7°C $\pm$ 2.7°C
Humidity : 50 %RH $\pm$ 20 %RH
Barometric Pressure : 1013 hPa $\pm$ 10 hPa
Received Date : 2 July 2024
Calibrated Date : 11 July 2024
Calibration Procedure : In-house method CP-SLM-01 based on IEC 61672-3 : 2013 Electroacoustics - Sound level meters - Part 3: Periodic tests
Location of Calibration : Lab Acoustic

Reference Standard

Instrument	Brand	Model	S/N	Due calibration	Traceability
Standard Microphone	GRAS	40AN	188273	20 August 2024	GRAS
Multi-frequency Calibrator	Quest	Quest-cal	EFA000234	26 July 2024	TSI
Audio Generator	Svante	Svan401	131	8 October 2024	WK Electric

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 Lungsart
Service Calibration Engineer

Approved By :
Mr. Pachi Mathavon
Calibration Engineer Supervisor
Issue Date : 11 July 2024

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
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File 100-1614-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-239
Request No : Req-2024-1458

1. Indication at the calibration check frequency

UUC Setting	Nominal	Before Adjust		After Adjust		UNCERTAINTY	Acceptance Limit	Result
FAST / A / 37-139		UUC	ERR	UUC	ERR			
Calibration Setting	(dB)	(dB)	(dB)	(dB)	(dB)	(± dB)	(± dB)	
1000 Hz 114 dB	112.76	115.1	134	113.8	+0.04	0.20	0.30	Pass

Note : Absolute sensitivity was established by the use of Sound Calibrator Brand SVANTEK, Model SV 35A, SN. 53079

2. Self-generated noise, Microphone installed

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	($\pm$ dB)
UUC Weighting	(dB)	($\pm$ dB)
A	27.5	0.10

3. Self-generated noise, Microphone replaced by the electrical input signal device

UUC Setting	Measured	UNCERTAINTY
FAST / 37-139	(dB)	($\pm$ dB)
UUC Weighting	(dB)	($\pm$ dB)
A	27.3	0.10
C	26.8	0.10
Z	31.0	0.10

4. Acoustic signal test of frequency weightings (Without Windscreen)

10. Acoustic signal test of frequency weighting curve (Previous Measurement)						
UUC Setting	Deviation from various Frequency Weighting Response curve			UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
	A	C	Z			
FAST / 37-139						
STD Setting	(dB)	(dB)	(dB)			
125 Hz	0.1	0.2	0.2	0.60	1.5	Pass
1000 Hz	0.0	0.0	0.0	0.60	1.0	Pass
4000 Hz	-0.7	-0.7	-0.7	0.60	3.0	Pass
8000 Hz	-1.7	-1.7	-1.6	0.70	5.0	Pass

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File 100-1614-01 Rev.04 Issue date 5/6/24

Certificate No : 24-SLM-239
Request No : Req-2024-1458

5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz

UUC Setting	Deviation from various Frequency			UNCERTAINTY	Acceptance Limit	Result
	Weighting Response curve					
FAST / 37-139	A (dB)	C (dB)	Z (dB)	($\pm$ dB)	($\pm$ dB)	
STD Setting				0.20	2.0	Pass
63 Hz	-0.2	-0.1	-0.1		1.5	Pass
125 Hz	-0.1	0.0	-0.1		1.5	Pass
250 Hz	-0.1	0.0	-0.1		1.5	Pass
500 Hz	-0.1	0.0	-0.1		1.0	Pass
1000 Hz	0.0	0.0	-0.1		2.0	Pass
2000 Hz	0.0	0.0	0.0		3.0	Pass
4000 Hz	0.0	0.0	0.0		5.0	Pass
8000 Hz	-0.1	-0.1	0.0		<5. -INF.	Pass
16000 Hz	-0.1	-0.1	-0.1			

6. Frequency and time weightings at 1kHz

UUC Setting	STD	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		REF	UUC	ERR		
FAST / 37-139	REF	UUC	ERR	0.20	0.20	Pass
UUC Weighting	(dB)	(dB)	(dB)			
A	114.00	114.0	0.0			
C	114.00	114.0	0.0			
Z	114.00	114.0	0.0		0.20	Pass

UUC Setting	STD	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		REF	UUC	ERR		
37-139 / A	REF	UUC	ERR	0.20	0.10	Pass
UUC Time Response	(dB)	(dB)	(dB)			
Fast	114.00	114.0	0.0			
Slow	114.00	114.0	-0.0			
Log	114.00	114.0	-0.0		0.10	Pass

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Certificate No : 24-SLM-239
Request No : Req-2024-1458

7. Long Term Stability

UUC Setting	Measured	UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
FAST / A / 37-139	UUC	0.10	0.30	Pass
STD Setting	(dB)			
Initial	114.0			
Final	114.0			
Deviated	0.0			

8. Level linearity on the reference level range

UUC Setting	Anticipated REF	Deviation		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
		UUC	ERR			
FAST / A / 37-139	REF	UUC	ERR	0.30	1.1	Pass
STD dB	(dB)	(dB)	(dB)			
139.00	139	139.0	0.0			
134.00	134	134.0	0.0			
129.00	129	129.0	0.0			
124.00	124	124.0	0.0			
119.00	119	119.0	0.0			
114.00	114	114.0	0.0			
109.00	109	109.0	0.0			
104.00	104	104.0	0.0			
99.00	99	99.0	0.0			
94.00	94	93.9	-0.1			
89.00	89	88.9	-0.1			
84.00	84	83.9	-0.1			
79.00	79	78.9	-0.1			
74.00	74	73.9	-0.1			
69.00	69	68.9	-0.1			
64.00	64	63.9	-0.1			
59.00	59	58.9	-0.1			
54.00	54	53.9	-0.1			
49.00	49	49.0	0.0			
44.00	44	44.0	0.0			
39.00	39	39.2	0.2			
34.00	34	34.3	0.3			
29.00	29	29.4	0.4			

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Certificate No : 24-SLM-239
Request No : Req-2024-1458

9. Level linearity including the level range control

UUC Setting		STD	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance	Result
FAST / A		REF	UUC	ERR		Limit	
UUC Range			(dB)	(dB)		($\pm$ dB)	
37-139		42.50	42.6	0.1	0.30	1.1	Pass
		114	114.0	0.0		1.1	Pass

10. Tone burst response

UUC Setting	STD	Anticipated Toneburst	Measured		UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
			Ref	UUC			
Fast	2	200	135.0	135.0	0.20	1.0	Pass
			118.0	117.8		+1.0, -2.5	Pass
			0.25	109.0		+1.5, -5.0	Pass
			0.25	109.0		1.0	Pass
Slow	2	200	128.6	128.5		+1.0, -5.0	Pass
			0.25	109.0		1.0	Pass
			0.25	109.0		+1.0, -2.5	Pass
			0.25	109.0		+1.5, -5.0	Pass

11. Peak C Sound level

UUC Setting	Anticipated	Measured		UNCERTAINTY	Acceptance Limit	Result
		REF	UUC			
FAST / C / 95-142	(dB)	(dB)	(dB)	($\pm$ dB)	($\pm$ dB)	
STD Setting						
Complete cycle	137.4	136.7	-0.70	0.20	3.0	Pass
Positive half cycle	136.4	136.2	-0.20		2.0	Pass
Negative half cycle	136.4	136.2	-0.20		2.0	Pass

The results related only to the item calibrated. The certificate shall not be reproduced except in full, without written approval of the calibration laboratory.
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Certificate No : 24-SLM-239
Request No : Req-2024-1458

12. Overload indication

UUC Setting	Measured	UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
FAST / A / 37-139	UUC	0.20	1.5	Pass
STD Setting	(dB)			
Positive one-half cycle	141.3			
Negative one-half cycle	141.2			
Deviated	0.1			

13. High Level Stability

UUC Setting	Measured	UNCERTAINTY ($\pm$ dB)	Acceptance Limit ($\pm$ dB)	Result
FAST / A / 37-139	UUC	0.10	0.30	Pass
STD Setting	(dB)			
Initial	138.0			
Final	138.0			
Deviated	0.0			

Note :

Function	Maximum-permitted Uncertainty of measurement
1. Indication at the calibration check frequency	Not applicable
2. Self-generated noise, Microphone installed	Not applicable
3. Self-generated noise, Microphone replaced by the electrical input signal device	Not applicable
4. Acoustic signal test of frequency weightings at 10 Hz to 4 kHz	0.60 dB
4. Acoustic signal test of frequency weightings at >4 kHz to 10 kHz	0.70 dB
5. Electrical signal test of frequency weightings, Weighting network response with relative to 1 kHz	0.20 dB
6. Frequency and time weightings at 1kHz	0.20 dB
7. Long Term Stability	0.10 dB
8. Level linearity on the reference level range	0.30 dB
9. Level linearity including the level range control	0.30 dB
10. Tone burst response	0.30 dB
11. Peak C Sound level	0.35 dB
12. Overload indication	0.25 dB
13. High Level Stability	0.10 dB

Acceptance limit and Maximum-permitted Uncertainty was IEC 61672-1:2013

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List of Instrument Certificates for Environmental Quality Analysis

No.	Instrument/Equipment	Parameter	Manufacturer	Model/Serial No.	Calibrator	Certification No.	Date of Calibration	Due date of Calibration*
1	Atomic Absorption Spectrometer	IRON MANGANESE	Agilent Technologies	AA240FS / MY13160001	Agilent Technologies (Thailand) Co.,Ltd.	Preventive Maintenance Checklist	24 Jan 24	23 Jan 25
2	Analytical Balance	TOTAL DISSOLVED SOLIDS	Mettler Toledo	XSR205DU / C210885394	National Food Institute,Ministry of Industry, Thailand	2402283-002-01	2 Apr 24	1 Apr 25
3	Hot Air Oven	TOTAL DISSOLVED SOLIDS	Memmert	UF55 / B212.0411	Technology Promotion Association (Thailand-Japan)	24TM589	1 Apr 24	31 Mar 25
4	pH Meter	pH	Horiba	LAQUA-PH210 / HA9M0047	technology promotion association (thailand-japan	24CH400	3 Apr 24	1 Apr 25
5	UV-VIS Spectrophotometer	SULPHATE	Hitachi	U-2900 / 21E22-009	DQE Services Co.,Ltd.	SP24-001	4 Jan 24	3 Jan 25
6	Turbidity Meter (Portable)	TURBIDITY (NTU)	Oakton Instruments(China)	T100IR / 1120501017	Technology Promotion Association (Thailand-Japan)	24CH1115	6 Sep 24	5 Sep 25

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

Agilent 55 240 280 Series Atomic Absorption Spectroscopy Systems

Preventive Maintenance Checklist

Agilent Preventive Maintenance provides factory recommended service for your analytical systems 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 installation.

Note: While non-current production AA instrument and/or accessory models are not covered specifically in this document it can be used as a basic reference.

For more information about Agilent Technologies services please visit our web site using the following URL: <http://www.agilent.com/en-us/services>

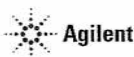
Introduction

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.

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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>
- 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 at <http://www.agilent.com/search/support>
- Get answers. Share insights. Build connections. Join the *Agilent Community* at <https://community.agilent.com/welcome>

Service Engineer's Responsibilities

- Contact the customer and ensure that all necessary supplies are available before the preventive maintenance visit.
- Confirm the ability of the instrument to deliver continued safe operation as established via the Agilent AA safe operation flow chart. (Refer directly to the AA 55/240/280 Preventive Maintenance Scope of Work to make this decision.)
- 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.

This information is subject to change without notice.

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Instrument Maintenance

System Information

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

Instrument System Name and ID	
Instrument System Site and Location	UNITED ANALYST AND ENGINEERING CONSULTANT / 2nd Lab

List System Component Product Numbers	List the Serial Numbers of each Component
1. G 8439 A	47 016 0001
2.	
3.	
4.	
5.	
6.	
7.	
8.	
9.	

Preparation, Safe operation and Initial performance checks

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Preventive Maintenance Procedures

FLAME SYSTEM section

- ☐ Section not applicable

Electronic components

- ☒ Review and confirm instrument configuration data in SVD
- ☒ Confirm power supply voltages using the *SVD Power Supply diagnostic*.
- ☒ For Dual Beam instruments - Confirm RBC frequency using the *SVD RBC frequency diagnostic*.

Mechanical components

- ☒ Check the burner adjuster controls for complete and free movement. If the burner adjuster needs lubrication, use Molykote 321 or mineral-based molybdenum disulphide grease.
- ☒ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☒ Monochromator drive
 - ☒ Slit drive
 - ☒ Lamp selector
 - ☐ ABA N/A

Optics components

- ☒ Check that external optical surfaces are clean – Clean or replace as required.
- ☒ Use SVD and perform *Mono Wavelength Correction*.
- ☒ Use SVD and perform *Slit Calibration*.
- ☒ Use SVD and perform *Grating Squareness Diagnostic*.
- ☒ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☒ Use SVD and perform *Wavelength Repeatability*.
- ☒ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.
- ☒ Check that the signal energy of the D2 and HC lamps track properly. Advise customer if their D2 lamp is showing emission degradation due to age.

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Sample Introduction and Atomization

- ☒ Inspect the burner interlock plate to ensure that the interlock pin is secure and correct for the burner type.
- ☒ Clean the burner slot with a clean white card.
- ☒ Check the uniformity of the slot width.
- ☒ Clean the burner if required.
- ☒ Change the burner o-ring.
- ☒ Clean the nebulizer, spray chamber and liquid trap.
- ☒ Change all o-rings and seals in the nebulizer, nebulizer block and spray chamber.
- ☒ Check that the pressure relief bung releases readily.
- ☒ Change o-rings on the fuel and oxidant delivery bars.
- ☒ Leave the liquid trap EMPTY and verify the flame will not ignite in this state.
- ☒ Refill liquid trap and check that overflow drains freely into the drain/waste tube.
- ☒ Check the drain/waste tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☒ Check and clean the igniter electrode.

Gas handling components and safety interlocks

- ☒ Pressure test for leaks
- ☒ Leak test gasbox internal components and connections
- ☒ Check safety interlock status and operation using the *SVD interlock monitoring diagnostic*.

Analytical performance for Flame systems

- ☒ Ignite a flame.
- ☒ Check that you can adjust the nebulizer uptake rate from 4 to 6.5 mL per minute.
- ☒ Optimize the instrument ready to perform Cu sensitivity test.
- ☒ Create a manual method to perform a Basic Cu ABS test - "Final Performance Testing"
- ☒ Run a PM completed sensitivity test for a 5 ppm copper sample and record the results in the AA PM Performance test results and measurements table.



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FURNACE SYSTEM section

- ☒ Section not applicable

Electronic components

- ☐ Review and confirm instrument configuration data in SVD
- ☐ Confirm power supply voltages using the *SVD Power Supply diagnostic*.

Mechanical components

- ☐ Run SVD tests to exercise all motor drives over the full range of their travel:
 - ☐ Monochromator drive
 - ☐ Slit drive
 - ☐ Lamp selector

Optics components

- ☐ Check that external optical surfaces are clean – Clean or replace as required.
- ☐ Use SVD and perform *Mono Wavelength Correction*.
- ☐ Use SVD and perform *Slit Calibration*.
- ☐ Use SVD and perform *Grating Squareness Diagnostic*.
- ☐ Use SVD and perform *Zero Order Offset/Mono Correction*.
- ☐ Use SVD and perform *Wavelength Repeatability*.
- ☐ Physically inspect selected HC lamps (customer to supply per their choice) and measure the % Gain for each lamp. Advise customer if lamps are showing emission degradation due to age.

Gas handling, water system and workhead component checks

- ☐ Inspect the GTA workhead gas hoses and connections for leaks.
- ☐ Pressure test for gas leaks
- ☐ If the cooler system is accessible (stand-alone) check for correct operation and coolant/water level – this includes any temperature and pressure settings plus filter cleaning (air flow and water).
- ☐ Inspect the GTA workhead water hoses and connections for leaks.
- ☐ Check all graphite components and replace if necessary.



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- ☐ Tube
- ☐ Electrodes
- ☐ Shroud

- ☐ Check and clean the end windows on the workhead.
- ☐ Check safety interlock operation.

Analytical performance for Furnace systems

- ☐ Optimize the instrument ready to perform Cu sensitivity test.
- ☐ Run the sensitivity test for a 25 ppb copper sample and record the results in the results table.

PSD autosampler accessory for Furnace systems

- ☒ Section NOT Applicable
- ☐ Check condition of the PSD capillary – replace if necessary
- ☐ Check condition and operation of PSD syringe – ensure it does not have air locks and bubbles.
- ☐ Change PSD rinse bottle o-ring.
- ☐ Check and clean the rinse vessel.
- ☐ Check the drain tube for good drainage. It should not have tight bends, kinks or loops and the lower end must be above the liquid level in the waste vessel.
- ☐ Ensure that the waste vessel is suitable for use with the furnace system.

Sample introduction pump system (SIPS) accessory

- ☒ Section NOT Applicable
- ☐ Re-torque screws securing the hubs, presser arms and pump rotors.
- ☐ Adjust each roller so that it rotates freely.
- ☐ Wipe clean the pump rotor rollers and pump bands with a dry clean cloth.
- ☐ Ensure that the presser arms and the surfaces near the pump are free from dirt and spills.
- ☐ Remove the pump module rear cover and check for the incursion of liquids and any signs of corrosion.
- ☐ Re-torque the nuts that fasten the motor mounting plates to the chassis.
- ☐ Check clips securing the diluents holder and replace if necessary.
- ☐ Disconnect, clean T-piece, and reassemble the tubing using the following steps.



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- ☐ Remove the T-piece by disconnecting the pump tubes, the pump bands and all other tubing.
- ☐ Place the T-piece in an ultrasonic bath containing strong detergent 1-5% Decon 30 or similar, for approximately 5-10 minutes.
- ☐ Wash the T-piece under a tap with a strong flow of water.
- ☐ Rinse with distilled water through all of the inlets in the reverse direction to normal sample flow.
- ☐ Reassemble.

Sample preparation system (SPS 4) accessory

- ☒ Section NOT Applicable

The Agilent SPS 4 autosampler is designed to need minimal maintenance.

The following maintenance requirements are suggested to maintain the performance of the autosampler.

- ☐ Cleaning the spill tray, rack location mat, end frames and chassis accessories with a damp soft cloth and diluted mild detergent.
- ☐ Cleaning the autosampler cover panels with domestic window cleaner.
- ☐ Checking the X- axis and Z- axis drive belts for cracks, splits, damaged teeth, excessive fraying, color changes or degradation from fumes.
- ☐ Check the X- axis, Theta- axis and Z- axis FFC cables for cracks, incorrect positioning, damaged edge or damaged connectors.

NOTE: The autosampler requires no extra lubrication throughout its lifetime.
For further details refer to the SPS 4 service manual G8410-90050.

Sample preparation system (SPS 3) accessory

- ☒ Section NOT Applicable

- ☐ Check the x-axis and z-axis timing belts – Replace if there is any cracks, splits or color deterioration and belt tension.
- ☐ Check belt tensions - adjust if required
- ☐ Check the lubrication pad for single x-axis shaft. If pad is dry or customer has observed any vibration or erratic movements of the x-axis carriage, add 1 mL of Dow Corning 200 @ Fluid, 200 CS into the well.
- ☐ Check the auto-sampler ability to find tube positions - Calibrate if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.



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Vapor generation accessory VGA (hydride generator)

- ☒ Section NOT Applicable
- ☐ Inspect VGA gas supply hose.
- ☐ Inspect/replace VGA pump tubing.
- ☐ Check low gas pressure interlock setting – adjust if required.
- ☐ Check precision orifice gas flow setting – adjust if required.
- ☐ Check gas regulator pressure to 46 psi (325 kPa) – adjust if required.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

UltraAA lamp accessory (external)

- ☒ Section NOT Applicable
- ☐ Check the condition of the power cable.
- ☐ Clean the exterior surfaces of the accessory with soft lint free cloth. This cloth can be dampened with warm water or a mild detergent. Do not use organic solvents or abrasive cleaning agents.

Restore System

- ☒ If you have altered the customer's instrumentation during the course of PM, restore to the original status to allow the customer to conduct their normal activities (e.g., reload the customer's method.)

Guidance

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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AA consumable and parts list table

Part Description		Product/Model # where used	PM supplied or Consumable	Instrument-Type
Test Solution – Cu 5ppm solution	6610030100	50 55 140 240 280	PM supplied	Common
Test Solution - Blank solution	5190-7001	50 55 140 240 280	PM supplied	Common
Copper, 1000 ug/ml, 100ml	5190-8279	50 55 140 240 280	*	Common
Kit, Mix 7 O-rings, aqueous, complete set	9910093400	50 55 140 240 280	PM supplied	Flame
Organic Kit	9910093500	50 55 140 240 280	PM supplied	Flame
Wire Nebulizer Cleaning	9910024700	50 55 140 240 280	consumable	Flame
Tubing-Capillary Std Nebs	9910024800	50 55 140 240 280	consumable	Flame
Capillary Tube Hvac Neb (3) (organics only)	9910044000	50 55 140 240 280	consumable	Flame
Glass Impact beads (5/pk)	9910025700	50 55 140 240 280	consumable	Flame
Teflon impact beads (5/pk) (organics only)	9910053300	50 55 140 240 280	consumable	Flame
Burner cleaning strip (100/pk)	9910053900	50 55 140 240 280	consumable	Flame
Window UV silica – round (right side)	2010082600	50 55 140 240 280	PM supplied	Common
Window UV silica – rectangular (left side)	2010082500	50 55 140 240 280	PM supplied	Common
Pad adhesive window (round)	4910012700	50 55 140 240 280	PM supplied	Common
Pad adhesive window (rectangular)	4910012800	50 55 140 240 280	PM supplied	Common
Electrode kit (1 pr) (D2)	6310033400	GTA120	PM supplied	Furnace
Shroud (D2)	6310033100	GTA120	PM supplied	Furnace
Zeeman electrode kit (1 pr)	6310033500	GTA120	PM supplied	Furnace
Zeeman shroud	6310033600	GTA120	PM supplied	Furnace
O-ring PSD rinse bottle	6910025900	PSD120	PM supplied	Furnace

* For engineers who only service AA instruments 5190-8279 can be used as a cheaper alternative for 6610030100.

Items classified as PM supplied in the above table are included in the standard PM

Those classified as consumable should be provided by the customer or charged to the customer if supplied by the Agilent service engineer.

Revision: 10.00, Issued: November 2021

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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 this service, parts replaced, and test results obtained with the customer.
- ☒ 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.

Test Results

Test Description		
Flame optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	44 %
Flame performance test with 5 ppm copper sample		
Air /acetylene, mixing paddle removed	Abs value > 0.5	0.7401 A-
Air /acetylene, mixing paddle installed, 10 replicates	%RSD < 1.0	0.5 % RSD
Deuterium furnace optics PMT Gain test		
For copper at 324.8 nm, 4 mA, 0.5 nm slit width	< 55 %	N/A
Deuterium furnace performance test with 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	N/A
Abs value	≥ 0.15	N/A
Zeeman furnace analytical performance: 25 ppb copper sample (327.4 nm)		
Precision %RSD	≤ 4.0%	N/A
Abs value	≥ 0.10	N/A
MSR%	≥ 70 %	N/A

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Service Engineer Comments (optional)

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

Service Completion

Service request number: 6006371115

Date service completed: 24 January 2024

Agilent signature: Woravit T.

Customer signature: Janda

Total number of pages in this document: 13

Revision: 10.00, Issued: November 2021

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SVD Results Report



Report ID: Diagnostic Start Time: 1/24/2024 9:41:24 AM Diagnostic End Time: 1/24/2024 10:10:55 AM

Customer: Service Engineer: Worawit T.
Address: Contact Details:

Instrument Configuration

Configuration:

Serial Number: MY13160001 Turret Type: Automatic
Instrument Model: Varian AA140/240/280 Number Of Lamps: 4
Flame Instrument: True Mono Type: Automatic
Furnace Instrument: True Gasbox Type: 'Y' Gas Box
Zeeman Present: False Auto Burner Adjuster: False
Internal Zeeman: False Mains Frequency: 50
Internal UltraAA: False Firmware Version: 2.11
Optics Type: Double Beam Photomultiplier Type: Normal(900nm)
D2 BG Correction Fitted: True PWB Version: 45
Boot Block Version: 1.09

EEPROM Data:

Instrument Run Hours: 62609.832 D2 Run Hours: 49136.000
Zero Wavelength Offset: 30.148 D2 Serial Number: not set 1
Mono Correction: 0.765 D2 Install Date: 1/1/1970
Flame Hours: 29802.416 D2 Original Intensity: 1.000
D2 Last Intensity: 475.000

Frequency:

Averaging Period: 30.0
Datapoint Count: 20

Upper Limit: 51.00 Highest Measured Frequency: 50.00
Average Frequency: 50.00
Lower Limit: 49.00 Lowest Measured Frequency: 50.00

Result: **Passed**

Report Generated At: 1/24/2024 10:11:18 AM

1

SVD Results Report

เอกสารไม่ควบคุม

Report Generated At: 1/24/2024 10:11:18 AM

2

SVD Results Report

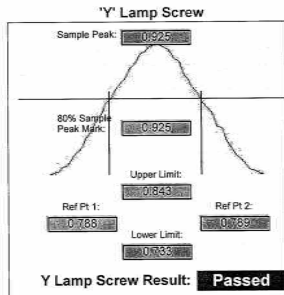
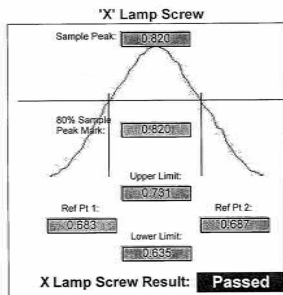
เอกสารไม่ควบคุม

Optics

Beam Balance:

Lamp Type: Copper
Lamp Socket Used: 3

Peak Selected: 324.80
Lamp Alignment: **Performed**



Grating Squareness:

Lamp Element(s): Copper
Lamp Turret Position: 3
Lamp Current(mA): 4.00
Slit Width(nm): 0.5
1st Order Wavelength(nm): 324.80
Lamp Alignment: **Performed**

	Lower Limit (nm)	Actual (nm)	Upper Limit (nm)	Result:
Zero Order	-0.10	0.00	0.10	Passed
First Order	324.45	324.75	325.15	Passed
Second Order	649.23	649.52	649.97	Passed

Report Generated At: 1/24/2024 10:11:18 AM

3

SVD Results Report

เอกสารไม่ควบคุม

Report Generated At: 1/24/2024 10:11:18 AM

4

SVD Results Report

เอกสารไม่ควบคุม

Power Supply:

Averaging Period: 30.0

Datapoint Count: 20

	Lower Limit (V)	Actual (V)	Upper Limit (V)	Result:
12.00 V Rail	10.80	12.19	13.20	Passed
-12.00 V Rail	-13.20	-11.90	-10.80	Passed
5.00 V Rail	4.50	5.05	5.50	Passed
310.00 V Rail	279.00	320.00	341.00	Passed

Mechanical

Wavelength Drive:	Passed
Slit Drive:	Passed
Turret Drive:	Passed
Auto Burner Adjuster Drive:	Untested

Miscellaneous

Signal Processing Linearity:				
Calculate Mode: New Calc Mode				
	Lower Limit	Actual	Upper Limit	Result:
S0	114	261	297	Passed
S1	156	165	191	Passed
S2	271	296	332	Passed
S3	474	507	579	Passed
S4	825	918	1008	Passed
S5	1435	1528	1754	Passed
S6	2498	2769	3053	Passed
S7	4347	4752	5313	Passed

Interlocks:	
Burner Fitted:	Working
N2O Burner Fitted:	Untested
Flame Shield Closed:	Working
Gas Control Fitted:	Untested
Pressure Release Bung Fitted:	Working
Liquid Trap Fitted:	Working
Flame Detect:	Working
GCU Active:	Working
Oxidant Pressure:	Working
Oxidant Changeover:	Untested
Ignition:	Working

Report Generated At: 1/24/2024 10:11:18 AM 5 SVD Results Report

เอกสารไม่ควบคุม

Auto Lamp Recognition:	
Lamp 1: Uncoded Lamp/Not Connected	Lamp 5: Not Supported
Lamp 2: 87 - Silver/Cadmium/Lead/Zinc(UltrAA) (Ag/C	Lamp 6: Not Supported
Lamp 3: 14 - Copper (Cu)	Lamp 7: Not Supported
Lamp 4: Uncoded Lamp/Not Connected	Lamp 8: Not Supported
Result: Passed	

GTA Temperature Monitoring:	Not Performed
-----------------------------	---------------

Notes:			
PM 24 Jan 2024			
Signatures:			
			
Date	24/1/24	Worawit T.	Date

Report Generated At: 1/24/2024 10:11:18 AM 6 SVD Results Report

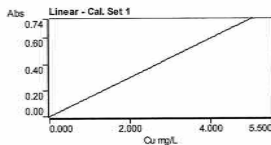
เอกสารไม่ควบคุม

Sequential by time report 1/24/2024 11:46 AM Page 1 of 1 SpectraAA

Analyst
Date Started 1/24/2024 11:39 AM GMT: 1/24/2024 4:39 AM
Worksheet Cu 5 PPM Sense check
Comment
Methods Cu
Computer name DESKTOP-R8UFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Conc. mg/L	%RSD	Mean Abs
CAL ZERO	0.000	55.0	0.0003
Readings			
	0.0002	0.0002	0.0004
	1/24/2024		
STANDARD 1	5.000	1.7	0.7419
Readings			
	0.7274	0.7515	0.7468
	1/24/2024		



Curve Fit = Linear
Characteristic Conc = 0.028 mg/L
r = 1.0000
Calculated Conc = 0.000 5.000
Residuals = 0.000 0.000

Abs = 0.14833 x C + 0.000295			
Sample 001	4.988	0.7	0.7401
Readings			
	0.7454	0.7399	0.7349
	1/24/2024		

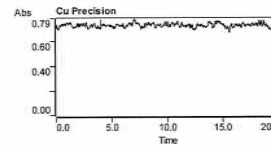
เอกสารไม่ควบคุม

Sequential by time report 1/24/2024 11:50 AM Page 1 of 1 SpectraAA

Analyst
Date Started 1/24/2024 11:47 AM GMT: 1/24/2024 4:47 AM
Worksheet Cu 5 PPM Precision
Comment
Methods Cu
Computer name DESKTOP-R8UFRS
Serial Number: MY13160001

Method: Cu (Flame)

Sample ID	Exp Abs	%RSD	Mean Abs
Cu Precision	0.723	0.5	0.7232
Readings			
	0.7221	0.7195	0.7226
	0.7201	0.7213	0.7265
		0.7283	0.7278
		0.7174	0.7260
		1/24/2024	



Calibration Certificate

Certificate No.: 2402283-002-01
Client name: UNITED ANALYST AND ENGINEERING CONSULTANT CO., LTD.
Address: 3 SOI UDOMSUK 41, SUKHUMVIT ROAD,
Bangchack, Prakhonong, Bangkok 10260

Page 1 of 4

Equipment: Electronic Balance

Manufacturer: METTLER TOLEDO

Model: XSR205DU

Serial No.: C210685394

ID No.: UAE.WAO.010/2565

Order No.: 2402283

Operation No.: 2402283-002

Date of Receipt: 2 April 2024

Date of Calibration: 2 April 2024

Calibrated by Mr.Jerawut Prapawuttipong
Scientist

Approved by
(Mr.Pheraphat Tuanjit)
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.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 2 of 4

Date of Calibration: 2 April 2024
Environment Condition: Ambient Temperature: 24.5 ± 0.5 °C Relative Humidity: 47.5 ± 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: NFI Method W-MA-001 In-House Method based on UKAS Lab 14 : 2019

2. Reference Standards:

Reference Standard	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Standard Weight Class E2	1mg to 200g	8505567572	TCS	M23040535	8 April 2024
Instrument	Model	Serial No.	Calibrated By	Certificate No.	Due Date
Thermo-Hygro Meter	608-H1	NFI.BTH 016/23	Quality Reborn	QR24-0343	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)
40	0.000042
80	0.000052
100	0.000048
200	0.000048

2. Off-Center Error:

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

The balance reading obtained is given in the table.

☒	☐	☐

1	2	3	4	5	6	(Maximum Difference)
(g)	(g)	(g)	(g)	(g)	(g)	(g)
100.0000	100.0001	99.9999	99.9999	100.0001	100.0000	0.0001

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

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 3 of 4

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 0 - 80 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 0 - 80 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
Unloaded	0.000000	0.000000	0.000000	0.0000086	2.00
0.001	0.001003	0.001011	-0.000011	0.0000089	2.00
0.005	0.005003	0.005000	0.000003	0.0000092	2.00
0.01	0.010003	0.010000	0.000003	0.0000089	2.00
0.05	0.049996	0.050000	0.000004	0.0000096	2.00
0.1	0.100011	0.100000	0.000011	0.000011	2.00
0.5	0.500016	0.500001	0.000015	0.000014	2.00
1	1.000003	1.000002	-0.000002	0.000016	2.00
2	2.000023	2.000001	0.000022	0.000017	2.00
5	5.000017	5.000002	0.000015	0.000020	2.00
10	10.000009	10.000000	0.000009	0.000026	2.00
20	20.000031	20.000000	0.000031	0.000037	2.00
30	30.000040	30.000001	0.000039	0.000050	2.00
50	50.000038	50.000002	0.000036	0.000068	2.00
80	80.000068	80.000002	0.000066	0.00011	2.00

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

Calibration Report

Certificate No.: 2402283-002-01
Equipment: Electronic Balance
Model: XSR205DU
Serial No.: C210685394
Capacity: 220 g
Manufacturer: METTLER TOLEDO
Resolution: 0.00001 g / 0.0001 g
ID No.: UAE.WAO.010/2565

Page 4 of 4

Date of Calibration: 2 April 2024

Calibration Results: (Continued)

Calibration Range: 81 - 200 g

Calibration Adjustment: Internal Calibration

3. Departure from Nominal Value: (Range: 81 - 200 g ; Resolution: 0.00001 g)

Nominal Value (g)	Standard Value (g)	Average Reading (g)	Correction (g)	Uncertainty (± g)	Coverage Factor k
90	90.000010	90.00001	0.00000	0.000015	2.00
100	100.000006	100.00001	0.00000	0.000015	2.00
110	110.000007	110.00001	0.00000	0.000016	2.00
120	120.000009	120.00000	0.00001	0.000017	2.00
130	130.000010	130.00000	0.00001	0.000019	2.00
140	140.000014	140.00000	0.00001	0.000020	2.00
150	150.000009	150.00001	0.00000	0.000020	2.00
160	160.000010	160.00001	0.00000	0.000022	2.00
170	170.000012	170.00001	0.00000	0.000023	2.00
200	200.000016	200.00002	0.00000	0.000028	2.00

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

----- End -----

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



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



Cert. No.: 24TM589
Page: 1 of 3

Certificate of Calibration

Equipment : Hot Air Oven
Manufacturer : Memmert
Model : UF 55
Serial No. : B212.0411
ID No. : UAE.WAO.005/2556
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong,
Bangkok 10260
Location : Lab Floor 2
Received Order : 01 April 2024
Calibration Date : 01 - 02 April 2024
Ambient Temperature : (26 ± 10) °C
Relative Humidity : (50 ± 30) %
Calibrated by : Krisda Malee
Approved by :
() Ponpan Palpim
(✓) Suwit Imjai
() Kunchit Promprat

Issue Date : 5 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

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A 0065065



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3

Cert. No.: 24TM589
Page: 2 of 3

Procedure Used :-

Calibration were conducted using calibration procedure CP-OT02 based on TLAS G-20 according to direct measurement method with Data Acquisition which connected with Resistance Temperature Detector (RTD) and Thermocouple Type T.

The temperature scale used was based on ITS-90.

Condition of this result of calibration

1. Reference standard instrument:-

Instrument	Serial No.	Cert. No.	Traceable	Due Date
1) Data Acquisition	MY57013711	23LM115	TPA	11 Jul 2024

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

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

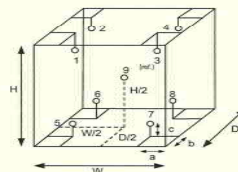
Remark : TPA : Technology Promotion Association (Thailand - Japan)

Result of Calibration :-

Function of UUC* : Temperature Source

Fresh air setting : Close

Environment during calibration		
	Beginning	Finished
Temp. (°C)	27	26
REL Humid. (%)	47	48
AC Supply (Volt)	221	220



Probe Installation Details : Dimension of Chamber :
a = 5.0 cm D = 0.50 m
b = 5.0 cm W = 0.80 m
c = 5.0 cm H = 0.75 m
Capacity = 0.30 m³

Ref. Std. ID No.: @ Calibration Point		
Position :	(120 to 180) °C	(104) °C
1	21-18TC-01	22-18RTD-2/1
2	21-18TC-02	18RTD-2/2
3	21-18TC-03	18RTD-2/3
4	21-18TC-04	18RTD-2/4
5	21-18TC-05	18RTD-2/5
6	21-18TC-06	18RTD-2/6
7	21-18TC-07	18RTD-2/7
8	21-18TC-08	18RTD-2/8
9 (ref.)	21-18TC-09	18RTD-2/9

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a 1209739



Equipment : Hot Air Oven
Condition As-Received : Used Item
Reference : 2404-0004OC-3
Result of Calibration : (*) Without Adjustment
Function of UUC* : Temperature Source
Fresh air setting : Close

Cert. No.: 24TM589
Page: 3 of 3

Calibration Point (°C)	UUC* Setting (°C)	UUC* Reading (°C)	Temperature stability (± °C)	Temperature uniformity (°C)	Overall Variation (°C)	Coverage Factor k
104.0	104.0	104.0	0.032	0.47	0.84	2
120.0	120.0	120.0	0.12	0.72	1.3	2
180.0	180.0	180.0	0.13	1.2	1.5	2

Calibration Point (°C)	Measured Temperature (°C)									Uncertainty (± °C)
	1	2	3	4	5	6	7	8	9 (ref.)	
104.0	104.464	103.847	104.226	104.232	104.106	103.691	104.275	104.127	104.013	0.42
120.0	120.486	120.089	120.635	120.596	119.531	119.644	120.364	120.144	120.158	1.1
180.0	180.574	179.769	180.285	180.870	179.594	179.790	180.287	179.961	179.802	1.1

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

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

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

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

UUC* : Unit Under Calibration

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

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

-o0o-

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a 1209738



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534/4 PATTANAKARN ROAD SOI 18, SUANLUANG, SUANLUANG BANGKOK 10250
TEL. 0-2717-3000-29 FAX. 0-2719-9484



Cert.No.: 24CH400
Page: 1 of 3

Certificate of Calibration

Equipment : pH Meter
Manufacturer : Horiba
Model : LAQUA-PH210
Serial No. : HA9M0047
ID No. : UAE.EFM.005/2563(EFM.pH.05/63)
Condition As-Received : Used Item
Received Date : 01 April 2024
Calibration Date : 02 April 2024
Reference : 2404-0037WSC-2
Submitted by : United Analyst and Engineering Consultant Co.,Ltd.
3 Soi Udomsuk 41, Sukhumvit Road,
Bangchak, Phrakhanong, Bangkok 10260
Ambient Temperature : (25 ± 2.5) °C
Relative Humidity : (50 ± 15) %
Calibration Procedure : In - house method :
- CP-CH5 by direct measurement with DC voltage standard and direct measurement with certified reference material (CRM)
- CP-CH8 by comparison with temperature standard

Calibrated by : Warakorn Lernagatrakul

Approved by :
Approved Signatory

() Pornthippa Tameyakul
() Unnopphol Harachai
(✓) Saitip Meangmai

Issue Date : 06 April 2024

The Uncertainties are for a confidence probability of approximately 95%

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

A 0062140



Cert.No.: 24CH400
Page.: 2 of 3

Condition of this calibration result

1. Reference Standard Instrument

Instrument	Serial No.	ID No.	Cert. No.	Due Date
1) Document Process Calibrator	54030049	130RC116	23E2802	27 Aug 2024
2) Ref. Standard Thermometer	4982054	110RC044	23I908	26 July 2024

This certification is traceable to the International System of Unit maintained through:-
- Technology Promotion Association (Thailand-Japan)

2. Certified Reference Materials

The measurement results are traceable to SI through CPA chem Ltd.,
ANSI-ASQ National Accreditation Board, Accredited No. AR-1835

Buffer Solution	Manufacturer	Lot No.	Exp. date
pH 4.008	CPA chem	940102	27 Nov 2025
pH 6.986	CPA chem	940104	02 Nov 2024
pH 9.997	CPA chem	940106	02 Nov 2024

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

Calibration Results

Function : mV Measurement

Performing standard curve by Document Process Calibrator at pH (4,7)(7,10)

Unit Under Calibration	Nominal Value		Standard Voltage Input		Actual Reading		Uncertainty of Measurement ($\pm$ mV)	Coverage factor k
	pH	mV	mV	pH	mV	pH		
pH Meter S/N.: HA9M0047	4.00	177.48	177.3	4.01	0.058	2.00	0.058	2.00
	7.00	0.00	0.0	7.01	0.058	2.00		
	7.00	0.00	0.0	7.01	0.058	2.00		
	10.00	-177.48	-177.4	10.01	0.058	2.00		

Sally

a 1209883



Cert.No.: 24CH400
Page.: 3 of 3

Calibration Results

Function : pH Measurement

Performing three buffers standard curve by using buffer nominal pH (4,7)(7,10)

Unit Under Calibration	Standard pH Buffer Solution	Actual pH Reading	Actual mV Reading (mV)	Uncertainty of pH Measurement ($\pm$)	Coverage factor k
pH Electrode S/N.: -	4.008	4.01	171.6	0.0079	2.00
	6.986	6.99	-8.4	0.0099	2.00
	6.986	7.00	-9.6	0.011	2.00
	9.997	10.02	-173.8	0.0096	2.00

Function : Temperature Measurement

(*) Without adjustment

This equipment was connected with Temperature Probe:

- Model : -
- Serial No. : -
Dimension of probe
- Length : 103 mm.
- Diameter : 16 mm.
- Immersion Depth : 90 mm.

Calibration Point (°C)	Standard Temperature (°C)	UUC* Reading (°C)	Error (°C)	Uncertainty of measurement ($\pm$ °C)	Coverage factor k
25.0	25.002	25.0	-0.002	0.13	2.00
30.0	30.002	30.0	-0.002	0.13	2.00
35.0	35.003	35.0	-0.003	0.13	2.00

Remark : - UUC* = Unit Under Calibration

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

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DQE Services Co., Ltd.



32 Soi Ladprao-Wanghin 55, Ladprao-Wanghin Rd., Ladprao, Bangkok 10230

Phone : +66 (0)2 538 2054, Email : dqeservicesinfo@gmail.com



CERTIFICATE OF CALIBRATION

Certificate No. : SP24-001

Page 1 of 5

Customer : United Analyst and Engineering Consultant Co., Ltd. (Head Office)

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

Location of calibration : Laboratory 213

Equipment : UV-Vis Spectrophotometer

Manufacturer : Hitachi

Model : U-2900

Serial No. : 21E22-009

ID No. : UAE.WAT.051/2564

Received Date : 4 January 2024

Calibration Date : 4 January 2024

Issue Date : 5 January 2024

Condition Instrument : Good

Calibrated by :

(Mr. Tanawat Rittidach)

Technical Manager

Approved by :

(Ms. Chonthicha Sangngern)

Quality Manager

The calibration result is applied only to the above calibrated item and was found accurate as shown on date and place of calibration only.
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 DQE Services Co., Ltd.

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FM-708-02 R01 1/11/2021

DQE Services Co., Ltd.



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REPORT OF CALIBRATION

Certificate No. : SP24-001

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Environment Condition : Ambient Temperature 25 ± 5 °C

Relative humidity 55 ± 20 %RH

Calibration method : In-house method CP-01 Based on ASTM E275-08

Certified Reference Materials :

Material	Serial No.	Certificate No.	Due date
Absorbance Standard set	25760	I15663	25 October 2025
Absorbance Standard set	25757	I15638	25 October 2025
Wavelength Standard set	25806	I15657	25 October 2025
Wavelength Standard set	25758	I15665	25 October 2025

Traceability : This certification is traceable to the International System of Unit maintained at National -

Institute of Standards and Technology (NIST) through Starna Scientific Limited

Spectral Band Width of UUC : 1.5 nm.

Scan Speed of UUC : 200 nm/min

Scan Interval of UUC : 0.1 nm.

Resolution of UUC : Photometric 0.001 Abs.

Wavelength 0.1 nm.

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FM-708-02 R01 1/11/2021

DQE Services

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NSC-TS1-17025
CALIBRATION MARK

REPORT OF CALIBRATION

Certificate No. : SP24-001

Page 3 of 5

Calibration Results : Without adjustment

Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
420	0.0000	0.000	0.0000	0.0028	2.00
	0.5780	0.575	0.0030	0.0031	2.00
	1.0484	1.045	0.0034	0.0029	2.00
	2.1876	2.192	-0.0044	0.0080	2.00
440	0.0000	0.000	0.0000	0.0028	2.00
	0.5595	0.558	0.0015	0.0034	2.00
	1.0239	1.023	0.0009	0.0035	2.00
	2.1230	2.125	-0.0020	0.0079	2.00
465	0.0000	0.000	0.0000	0.0028	2.00
	0.5230	0.520	0.0030	0.0030	2.00
	0.9633	0.961	0.0023	0.0029	2.00
	1.9753	1.975	0.0003	0.0070	2.00
546.1	0.0000	0.000	0.0000	0.0028	2.00
	0.5181	0.516	0.0021	0.0031	2.00
	1.0002	0.997	0.0032	0.0033	2.00
	1.9973	1.993	0.0043	0.0084	2.00
590	0.0000	0.000	0.0000	0.0028	2.00
	0.5517	0.550	0.0017	0.0030	2.00
	1.0803	1.079	0.0013	0.0030	2.00
	2.0373	2.032	0.0053	0.0080	2.00
635	0.0000	0.000	0.0000	0.0028	2.00
	0.5591	0.558	0.0011	0.0031	2.00
	1.0518	1.050	0.0018	0.0030	2.00
	1.9274	1.923	0.0044	0.0079	2.00

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CALIBRATION MARK

REPORT OF CALIBRATION

Certificate No. : SP24-001

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Photometric Accuracy :

Wavelength (nm.)	CRMs Values (Abs)	UUC Reading (Abs)	Correction (Abs)	Uncertainty (Abs)	Coverage factor k
235	0.0000	0.000	0.0000	0.0050	2.00
	0.7469	0.743	0.0039	0.0057	2.00
257	0.0000	0.000	0.0000	0.0050	2.00
	0.8674	0.862	0.0054	0.0059	2.00
313	0.0000	0.000	0.0000	0.0050	2.00
	0.2919	0.289	0.0029	0.0051	2.00
350	0.0000	0.000	0.0000	0.0050	2.00
	0.6430	0.641	0.0020	0.0055	2.00

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FM-708-02 R01 1/11/2021

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CALIBRATION MARK

REPORT OF CALIBRATION

Certificate No. : SP24-001

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Wavelength Accuracy :

CRMs Values (nm.)	UUC Reading (nm.)	Correction (nm.)	Uncertainty (nm.)	Coverage factor k
241.72	241.2	0.52	0.18	2.00
279.45	279.0	0.45	0.18	2.00
287.81	287.4	0.41	0.18	2.00
334.06	333.8	0.26	0.18	2.00
360.93	360.6	0.33	0.18	2.00
418.59	418.4	0.19	0.18	2.00
445.94	445.8	0.14	0.18	2.00
453.66	453.4	0.26	0.18	2.00
460.02	459.8	0.22	0.18	2.00
536.59	536.4	0.19	0.18	2.00
637.98	638.0	-0.02	0.18	2.00
431.38	431.2	0.18	0.18	2.00
472.50	472.5	0.00	0.18	2.00
513.47	513.4	-0.07	0.18	2.00
528.88	528.9	-0.02	0.18	2.00
573.17	573.4	-0.23	0.18	2.00
585.35	585.2	0.15	0.20	2.00
684.40	684.4	0.00	0.18	2.00
740.72	741.0	-0.28	0.20	2.00
748.55	748.8	-0.25	0.18	2.00
807.03	807.1	-0.07	0.18	2.00
879.28	879.5	-0.22	0.18	2.00

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FM-708-02 R01 1/11/2021

TECHNOLOGY PROMOTION ASSOCIATION (THAILAND-JAPAN)

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

NSC-TS1-17025
CALIBRATION MARK

Certificate of Calibration

Cert.No.: 24CH1115

Page.: 1 of 2

Equipment : Turbidity Meter

Manufacturer : Oakton

Model : T100IR

Serial No. : 1120501017

ID. No. : UAE.WAT.056/2563

Condition As-Received: Used Item

Received Date : 05 September 2024

Calibration Date : 06 September 2024

Reference : 2409-0177DSC-1

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

Ambient Temperature : (25 ± 2.5) °C

Relative Humidity : (50 ± 20) %

Calibration Procedure : In - house method : CP-CH11
Direct measurement by
using Formazin standard solution

Calibrated by : Walalak Sirinthean

Approved by :

Sathip

Approved Signatory

() Unnophol Harachai

() Ponpan Palpim

(✓) Sathip Meangmai

Issue Date : 9 September 2024

The Uncertainties are for a confidence probability of approximately 95%

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Approval of the head of Calibration and Testing Equipment Services.

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Cert.No. : SICH1115

Page : 2 of 2

Condition of this calibration result

1. Reference Standard Instruments :

Instruments	Serial No.	ID No.	Certificate No.	Due date
1) Thermo-Hygrometer	1103038	138EC014	24H1372	12 July 2025
2) Electronic Balance	1126143754	140PC004	22HM22	20 Feb 2025

- This Certificate is traceable to SI Through Technology Promotion Association (Thailand - Japan)

2. Standard Material : The Formazin suspension has been prepared gravimetric from

Material	Manufacturer	Lot No.	Assay
1) Hexamethylenetetramine	HIMEDIA	0806463847	99.65%
2) Hydrochloric Sulfate	HIMEDIA	0005022014	99.40%

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

Calibration result

Performing five - Formazin suspension standard curve by using 0,20,100,400,800 NTU

Turbidity Meter Serial Number : 1120501017

Standard Formazine suspension (NTU)	UUC* Reading (NTU)	Uncertainty of Measurement (± NTU)	Coverage Factor k
2	0.00	0.0081	2.06
20	20.2	0.38	2.06
100	100	0.75	2.06
400	401	1.5	2.06
800	801	2.1	2.17

Remark : - UUC* = Unit Under Calibration

- NTU = Nephelometric Turbidity Units

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

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