

Certificate of Calibration



Equipment:	Balance	Certificate No.:	C01172098
Model:	AZ214	Issued Date:	13 June 2017
Serial No. (or ID.):	28092281	Job No.:	KCAL1707222
Manufacturer:	Sartorius	Page:	1 of 3
Condition:	In condition		

Customer: MINE ENGINEERING CONSULTANT CO.,LTD.
124/37 Moo 1, Rangsit-Phatumthani Road,
Banklang, Mueng, Phatumthani 12000 Thailand.

Environment Condition: Temperature 27 °C \pm 0.5 °C
Humidity 52 %RH \pm 0.7 %RH

Calibration Place: MINE ENGINEERING CONSULTANT CO.,LTD. (Laboratory 1)
124/37 Moo 1, Rangsit-Phatumthani Road,
Banklang, Mueng, Phatumthani 12000 Thailand.

Calibration By: Mr. Siwapan Sreejan

Calibration Date: 12 June 2017

The Method used: In house method, SPCC-WI-47, base on UKAS Lab 14

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC Calibration Center Co., Ltd. Certificate No. C02170425



(Mr. Siwapan Sreejan)

Person in charge



(Mr. Thalerngkeat Pong-ngarm)

Weighing Division Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.




The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

This calibration certificate shall not be reproduced except in full only, without written approval from SPC Calibration Center Co., Ltd.

Calibration Results:

Before Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.

			Nominal Test Value	50	(g)
Reference Points (g)					
A	B	C	D	E	
-	0.0003	0.0003	-0.0002	-0.0003	

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

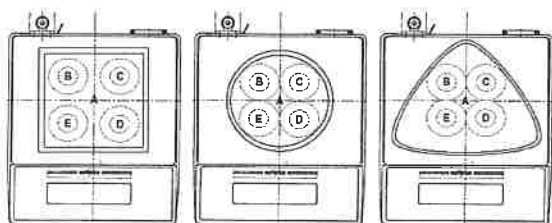
Nominal test value (g)	Standard Deviation
20	0.00004
200	0.00006

Departure of indication from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	0.99999	1.0000	0.0000	0.00011	2.04
2	2.00000	2.0000	0.0000	0.00011	2.04
5	5.00000	5.0000	0.0000	0.00011	2.04
10	9.99999	10.0000	0.0000	0.00011	2.04
20	19.99998	20.0000	0.0000	0.00012	2.03
50	49.99998	50.0001	-0.0001	0.00013	2.00
100	99.99994	100.0001	-0.0002	0.00017	2.00
120	119.99992	120.0002	-0.0003	0.00021	2.00
150	149.99992	150.0003	-0.0004	0.00024	2.00
200	200.00003	200.0004	-0.0004	0.00030	2.00

After Adjustment

Eccentric Error: Weight to be 1/4 or 1/3 of Maximum capacity, taken from the center of the pan as a zero reference.



Nominal Test Value 50 (g)

Reference Points (g)				
A	B	C	D	E
-	0.0001	0.0001	-0.0001	-0.0002

Repeatability: Determination of the standard deviation of weighing balance., Readability 0.0001 (g)

Nominal test value (g)	Standard Deviation
20	0.00003
200	0.00006

Departure of indication from nominal value., Readability 0.0001 (g)

Nominal Value (g)	Conventional Mass (g)	Displayed Value (g)	Correction of Balance (g)	Uncertainty (g)	k
1	0.99999	1.0000	0.0000	0.00011	2.04
2	2.00000	2.0000	0.0000	0.00011	2.04
5	5.00000	5.0000	0.0000	0.00011	2.04
10	9.99999	10.0000	0.0000	0.00011	2.04
20	19.99998	20.0000	0.0000	0.00012	2.03
50	49.99998	50.0000	0.0000	0.00013	2.00
100	99.99994	100.0000	-0.0001	0.00017	2.00
120	119.99992	120.0000	-0.0001	0.00021	2.00
150	149.99992	150.0000	-0.0001	0.00024	2.00
200	200.00003	200.0000	0.0000	0.00030	2.00

The End of Certificate



Certificate Of Calibration

Item Sound Calibrator
Brand : QUEST
Model : CA - 12B

Cer. No. HC168176

Page 1

Serial Number : U2040047 **ID.NO. :**

Client : บริษัท ไมน์ เอ็นจิเนียริง คอนซัลแตนท์ จำกัด
124/37 หมู่ 1 ถนนรังสิต-ปทุม ค.บ้านกลาง อ.เมือง จ.ปทุมธานี 12000

Room Ambient Condition **Temperature :** 24.10 **Celsius** **Humidity :** 54.00 %

Calibrated Date 5 November 2016 **Due Date** 5 November 2017

Calibrated By Kiattisak Moon **Procedure Used** TS/F/CL/178

STANDARD USED

Description/Model	Serial Number	Manufacturing	Traceability No.	Due Date
PRECISION INTERATING SOUND LEVEL	1351	LARSON DAVIS	EEL.BP.15/0859	7 September 2017
DIGITAL THERMO-HYGROMETER	135049868	DIGICON	HC166283	21 September 2017

Result See Data Attached

The Report Uncertainty of Masurement was based on Standard Uncertainty Multiplied By a Coverage
 $k = 2$,Providing a Level of Confidence of Approximately 95 %

This Certification is traceable to

- Thailand Institute of Scientific and Technological Research (Tistr)
- Hospital Assets Management Service Co.,Ltd.,GIIC Calibration Laboratory, And The National Institute of Standards and

Calibrated By :

(Kiattisak Moon)
Engineer



Approved By :

(Phichet Tubbuchakorn)
Service Manager

บริษัท ฮอสพิทอล เอสเสทส์ แมเนจเม้นท์ เซอร์วิส จำกัด

81/10 หมู่ที่ 3 ค.หน้าไม้ อ.ลาดหลุมแก้ว จ.ปทุมธานี 12140 โทร. 0-2433-9682-4 แฟกซ์ 0-2433-9685

Calibration Results

Cer. No. HC 168176

Page 2

1	P	F	N	Qualitative Tests	Comments
1.1	✓			Chassis / Housing	
1.2	✓			Mount	
1.3			✓	Caster / Brakes	
1.4			✓	AC Plug / Receptacles	
1.5			✓	Line Cord	
1.6			✓	Strain Reliefs	
1.7			✓	Circuit Breaker / Fuse	
1.8			✓	Tubes / Hoses	
1.9			✓	Cables	
1.10			✓	Fittings / Connectors	
1.11			✓	Electrodes / Transducers	
1.12			✓	Filters	
1.13	✓			Controls / Switches	

1	P	F	N	Qualitative Tests	Comments
1.14			✓	Heater	
1.15			✓	Motor / Pump / Fan / Compressor	
1.16			✓	Fluid Levels	
1.17	✓			Battery / Charger	
1.18	✓			Indicators / Displays	
1.19			✓	User Calibration / Self-Test	
1.20	✓			Alarms / Interlocks	
1.21	✓			Audible Signals	
1.22	✓			Labeling	
1.23			✓	Accessories	
1.24					
1.25					

2	P	F	N	Quantitative Tests	Comments		
2.1			✓	Grounding Resistance : _____ Ω			
2.2			✓	Leakage Current > Chassis : _____ μA Leads : _____ μA			
2.3							
2.4							
2.5							
2.6							
2.7							
2.8							
2.9							
2.10	✓			Sound Pressure Level Test			
	Units	Setting	Indicated / Actual	Actual (Average)	Error	%Error	± Uncertainty
	dB	110	-	109.74	-0.26	-0.24	0.076
<input type="checkbox"/>	Uncalculate						
2.11	✓			Frequency Test			
	Units	Setting	Indicated / Actual	Actual (Average)	Error	%Error	± Uncertainty
	Hz	1000	-	998.00	-2.00	-0.20	0.058
<input type="checkbox"/>	Uncalculate						
2.12			✓				
	Units	Setting	Indicated / Actual	Actual (Average)	Error	%Error	± Uncertainty
<input type="checkbox"/>	Uncalculate						

3	Check if Done	Preventive Maintenance	Description and Comments
3.1	N	Clean	
3.2	N	Lubricate	
3.3	N	Calibrate / Adjust	
3.4	N	Replace	

Comments :

Status :

☐ Passed
☐ Service Required
☐ Removed From Use



P = Pass F = Fail N = Not Test

Certificate of Calibration



Equipment:	pH METER	Certificate No.:	C07170344		
Model:	pH700	Issued Date:	14 June 2017		
Serial No. (or ID.):	983068	Job No.:	KCAL1707228		
Manufacturer:	EUTECH	Page:	1 of 4		
Electrode Serial No.	126	Model:	01X099320	Brand :	EUTECH
Condition:	In Condition				

Customer: MINE ENGINEERING CONSULTANT CO.,LTD.
124/37 Moo 1, Rangsit-Phatumthani Road,
Banklang, Mueng, Phatumthani 12000 Thailand.

Environment Condition: Temperature 23 °C ± 2 °C
Humidity 50 %RH ± 15 %RH

Calibration Place: Environment Laboratory, SPC Calibration Center Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Dumrong Boonsopon

Calibration Date: 14 June 2017

The Method used: In house method, SPCC-WI-22, base on ASTM E 70-07

Traceability: This certificate is traceable to the CRM maintained by DAkkS/DKD calibration laboratory through Radiometer Analytical Co., Ltd. Certificate No. 1128, 1144, 1137 and traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through Industrial Foundation Electrical and Electronics Institute Certificate No. 0418EL16



(Mr. Dumrong Boonsopon)

Person in charge



(Mr. Nitinun Srihawan)

Chem&Envi Division Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

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Calibration Results:

pH Scale

Input	pH Meter Reading			Uncertainty of Measurement (mV)	Coverage Factor (k)
	(mV)	Error (mV)	(pH)		
414.12	414	-0.12	0.02	0.58	2.00
354.96	355	0.04	1.02	0.58	2.00
295.80	296	0.20	2.02	0.58	2.00
236.64	237	0.36	3.01	0.58	2.00
177.48	177.5	0.02	4.00	0.083	2.00
118.32	118.3	-0.02	5.00	0.083	2.00
59.16	59.2	0.04	6.00	0.083	2.00
0.00	0.0	0.00	7.00	0.083	2.00
-59.16	-59.2	-0.04	8.00	0.083	2.00
-118.32	-118.4	-0.08	8.99	0.083	2.00
-177.48	-177.5	-0.02	9.99	0.083	2.00
-236.64	-237	-0.36	10.99	0.58	2.00
-295.80	-296	-0.20	11.98	0.58	2.00
-354.96	-355	-0.04	12.98	0.58	2.00
-414.12	-414	0.12	13.97	0.58	2.00

Electrode Test Results*

The two-point calibration using two standard buffer solutions; pH 4.004 and pH 7

The practical slope of the pH electrode; 58.35 (mV/pH), 98.64%

The zero point of the pH electrode; 6.65 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.004	4.00	-0.0040	0.026	2.00
7.000	7.00	0.0000	0.042	2.00
10.013	9.97	-0.0430	0.068	2.00

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

Electrode Test Results*

The two-point calibration using two standard buffer solutions; pH 7 and pH 10.013

The practical slope of the pH electrode; 57.74 (mV/pH), 97.60%

The zero point of the pH electrode; 6.68 (pH)

Sample Test Results

Standard Buffer Solution (pH)	Unit Under Calibration (pH)	Difference (pH)	Uncertainty of Measurement (pH)	Coverage Factor (k)
4.004	3.97	-0.0340	0.032	2.00
7.000	7.00	0.0000	0.028	2.00
10.013	10.01	-0.0030	0.044	2.00

* Calibration Marked " Not TISI Accredited " in this Certificate have been included for completeness.

The End of Certificate

Certificate of Calibration

Equipment:	Digital Thermometer	Certificate No.:	C15170115
Model:	pH 700	Issued Date:	13 June 2017
Serial No. (or ID.):	983068	Job No.:	KCAL1707229
Manufacturer:	Eutech	Page:	1 of 2
Sensor Type:	Thermistor	Condition:	In Condition
Diameter:	3 mm	Range / Channel:	-
Length:	112 mm	Immersion:	110 mm

Customer: MINE ENGINEERING CONSULTANT CO.,LTD.
124/37 Moo 1, Rangsit-Phatumthani Road,
Banklang, Mueng, Phatumthani 12000 Thailand.

Environment Condition: Temperature: 22 °C ± 3.0 °C
Humidity: 50 %RH ± 15.0 %RH
Voltage: 230 VAC ± 11.0 VAC

Calibration Place: Sensor Laboratory, SPC Calibration Center Co., Ltd.
1194 Soi Wachirathamsathit 57, Sukhumvit 101/1 Rd.,
Bangchak, Prakanong, Bangkok 10260 Thailand

Calibration By: Mr. Sawet Ngamlamai

Calibration Date: 13 June 2017

The Method used: In house method, SPCC-WI-19, by comparison with standard

Traceability: This certificate is traceable to the SI Units maintained by Thailand Institute of Scientific and Technological Research (TISTR), Thailand through SPC Calibration Center Co., Ltd. Certificate No. PSL-T 397/60



(Mr. Sawet Ngamlamai)

Person in charge



(Mr. Thalerngkeat Pong-ngarm)

Technical Management Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

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Calibration Results:

Without adjustment:

Desired Temp.(°C)	Std. Reading (°C)	UUC. Reading (°C)	Correction of UUC (°C)	Uncertainty (\pm °C)
25.0	25.003	25.1	-0.097	0.11

The End of Certificate

ORIFICE TRANSFER STANDARD CERTIFICATION WORKSHEET TE-5025A

Date - Mar 20, 2017 Rootsmeter S/N 0438320 Ta (K) - 293
Operator Tisch Orifice I.D. - 2262 Pa (mm) - 759.46

PLATE OR Run #	VOLUME START (m3)	VOLUME STOP (m3)	DIFF VOLUME (m3)	DIFF TIME (min)	METER DIFF Hg (mm)	ORFICE DIFF H2O (in.)
1	NA	NA	1.00	1.4290	3.2	2.00
2	NA	NA	1.00	1.0190	6.4	4.00
3	NA	NA	1.00	0.9130	7.9	5.00
4	NA	NA	1.00	0.8730	8.8	5.50
5	NA	NA	1.00	0.7170	12.8	8.00

DATA TABULATION

Vstd	(x axis) Qstd	(y axis)	Va	(x axis) Qa	(y axis)
1.0120	0.7082	1.4257	0.9958	0.6968	0.8784
1.0078	0.9890	2.0163	0.9916	0.9731	1.2423
1.0057	1.1015	2.2543	0.9895	1.0838	1.3889
1.0045	1.1507	2.3643	0.9884	1.1322	1.4567
0.9992	1.3936	2.8514	0.9831	1.3712	1.7568
Qstd slope (m) = 2.08552			Qa slope (m) = 1.30592		
intercept (b) = -0.04627			intercept (b) = -0.02851		
coefficient (r) = 0.99979			coefficient (r) = 0.99979		
y axis = $\sqrt{H_2O(Pa/760)(298/Ta)}$			y axis = $\sqrt{H_2O(Ta/Pa)}$		

CALCULATIONS

$$Vstd = \text{Diff. Vol}[(Pa - \text{Diff. Hg})/760](298/Ta)$$

$$Qstd = Vstd/Time$$

$$Va = \text{Diff Vol}[(Pa - \text{Diff Hg})/Pa]$$

$$Qa = Va/Time$$

For subsequent flow rate calculations:

$$Qstd = 1/m\{[\sqrt{H_2O(Pa/760)(298/Ta)}] - b\}$$

$$Qa = 1/m\{[\sqrt{H_2O(Ta/Pa)}] - b\}$$

Calibration Certificate

Part Number: 721A2501
Description: Micromate ISEE Base Unit

Serial Number: UM11031
Calibration Date: NOV 02 2016
Calibration Equipment: 714J7402

Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By:


Xiaoming Yang

 **Instantel**

Calibration Certificate

Part Number: 721A0201
Description: MicroMate Linear Mic (2-250Hz)

Serial Number: UL2549
Calibration Date: NOV 02 2016
Calibration Equipment: 714J7402

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Calibrated By:


Ninh Nguyen

 **Instantel**

Microphone Stand Assembly (Part No. 720A6001)

Explanation

The Microphone Stand Assembly provides increased flexibility for various heights dependent on assembly, as follows:

Number of Sections	Assembled Height
• 3 Sections	33.25" (84.46 cm),
• 2 Sections	22.25" (56.52 cm)
• 1 Section	13.25" (22.02 cm) (Requires optional Ground Spike, Part No. 1100241)

If height is required beyond the three combined sections, additional sections may be ordered or used from another existing microphone stand assembly.

Package Contents

Microphone Stand Assembly Part No. 720A6001

Tools and Materials Required

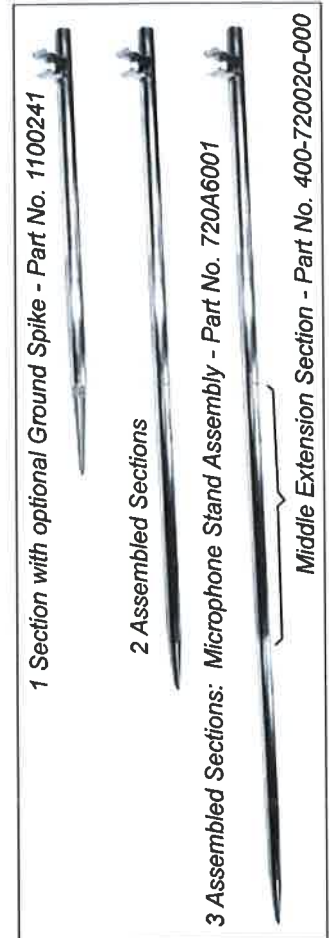
- Microphone Stand Assembly, Part No. 720A6001.
- Optional Microphone Stand Assembly Extension Section, Part No. 400-720020-000, for extended length installations.
- Optional Geophone Spike, 3" (75 mm), Part No. 1100241, for short length installations.
- Rubber mallet, as required.

Installation

1. Determine the required height and assemble the Microphone Stand by firmly hand-tightening the sections together. Do not use tools, such as a pliers or vice grips, to tighten the sections as this may damage the threads.
2. Locate the Microphone Stand Assembly and ensure that the clip will allow you to insert the microphone oriented towards the event to be recorded.
3. Firmly push the Microphone Stand Assembly into the ground using your hand, or if the ground is too solid, use a rubber mallet and strike the top of the stand, being careful not to damage in the microphone clip. DO NOT use a metal hammer as it will damage the stand.
4. Install the microphone into the clip.

Use your hand or a rubber mallet to install the Microphone Stand; clip on the microphone.

NOTE: DO NOT use a metal hammer as it will damage the microphone stand.



The World's Most Trusted Vibration Monitors

www.instantel.com

Microphone Stand Assembly (Part No. 720A6001)

Explanation

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• 3 Sections	33.25" (84.46 cm),
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If height is required beyond the three combined sections, additional sections may be ordered or used from another existing microphone stand assembly.

Package Contents

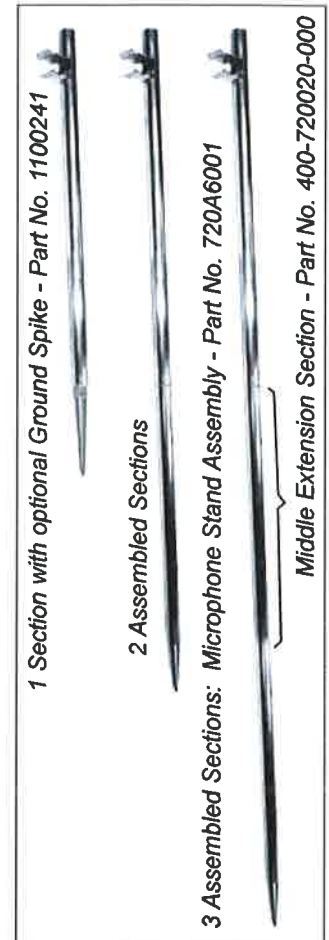
Microphone Stand Assembly Part No. 720A6001

Tools and Materials Required

- Microphone Stand Assembly, Part No. 720A6001.
- Optional Microphone Stand Assembly Extension Section, Part No. 400-720020-000, for extended length installations.
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Use your hand or a rubber mallet to install the Microphone Stand; clip on the microphone.

NOTE: DO NOT use a metal hammer as it will damage the microphone stand.



The World's Most Trusted Vibration Monitors

www.instantel.com

Calibration Certificate

Part Number: 721A2501
Description: Micromate ISEE Base Unit

Serial Number: UM11032
Calibration Date: NOV 02 2016
Calibration Equipment: 714J7402


Instantel certifies that the above product was calibrated in accordance with the applicable Instantel procedures. These procedures are part of a quality system that is designed to assure that the product listed above meets or exceeds Instantel specifications.

Instantel further certifies that the measurement instruments used during the calibration of this product are traceable to the National Institute of Standards and Technology; or National Research Council of Canada. Evidence of traceability is on file at Instantel and is available upon request.

The environment in which this product was calibrated is maintained within the operating specifications of the instrument.

Please note that the sensor check function is intended to check that the sensors are connected to the unit, installed in the proper orientation and sufficiently level to operate properly. This function should not be confused with a formal calibration, which requires the sensors be checked against a reference that is traceable to a known standard. Instantel recommends that products be returned to Instantel or an authorized service and calibration facility for annual calibration.

Calibrated By:


Xiaoming Yang

 **Instantel**

Calibration Certificate

Part Number: 721A0201
Description: MicroMate Linear Mic (2-250Hz)

Serial Number: UL2550
Calibration Date: NOV 02 2016
Calibration Equipment: 714J7402

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Calibrated By: _____

Ninh Nguyen



Microphone Stand Assembly (Part No. 720A6001)

Explanation

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Number of Sections	Assembled Height
• 3 Sections	33.25" (84.46 cm),
• 2 Sections	22.25" (56.52 cm)
• 1 Section	13.25" (22.02 cm) (Requires optional Ground Spike, Part No. 1100241)

If height is required beyond the three combined sections, additional sections may be ordered or used from another existing microphone stand assembly.

Package Contents

Microphone Stand Assembly Part No. 720A6001

Tools and Materials Required

- Microphone Stand Assembly, Part No. 720A6001.
- Optional Microphone Stand Assembly Extension Section, Part No. 400-720020-000, for extended length installations.
- Optional Geophone Spike, 3" (75 mm), Part No. 1100241, for short length installations.
- Rubber mallet, as required.

Installation

1. Determine the required height and assemble the Microphone Stand by firmly hand-tightening the sections together. Do not use tools, such as a pliers or vice grips, to tighten the sections as this may damage the threads.
2. Locate the Microphone Stand Assembly and ensure that the clip will allow you to insert the microphone oriented towards the event to be recorded.
3. Firmly push the Microphone Stand Assembly into the ground using your hand, or if the ground is too solid, use a rubber mallet and strike the top of the stand, being careful not to damage in the microphone clip. DO NOT use a metal hammer as it will damage the stand.
4. Install the microphone into the clip.



Use your hand or a rubber mallet to install the Microphone Stand; clip on the microphone.

NOTE: DO NOT use a metal hammer as it will damage the microphone stand.



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Certificate of Calibration



Equipment:	Water Bath	Certificate No.:	C13170178
Model:	WNB 22	Issued Date:	16 June 2017
Serial No. (or ID.):	L512.1477	Job No.:	KCAL1707224
Manufacturer:	Memmert	Page:	1 of 3
Condition:	In Condition		
Forced Circulation:	None		

Customer: MINE ENGINEERING CONSULTANT CO.,LTD.
124/37 Moo 1, Rangsit-Phathumthani Road,
Banklang, Mueng, Phathumthani 12000 Thailand.

Environment Condition:	Temperature:	28	±	0.2	°C
	Humidity:	61	±	1.2	%RH
	Voltage:	228	±	0.7	VAC

Calibration Place: MINE ENGINEERING CONSULTANT CO.,LTD. (Laboratory 2)
124/37 Moo 1, Rangsit-Phathumthani Road,
Banklang, Mueng, Phathumthani 12000 Thailand.

Calibration By: Mr. Preecha Phooarsai

Calibration Date: 12 June 2017

The Method used: In house method, SPCC-WI-17, base on ASTM E715-80 (2011)

Traceability: This certificate is traceable to the SI Units maintained by National Institute of Metrology (NIMT), Thailand through SPC Calibration Center Co., Ltd. Certificate No. C10160012



(Mr. Preecha Phooarsai)

Person in charge



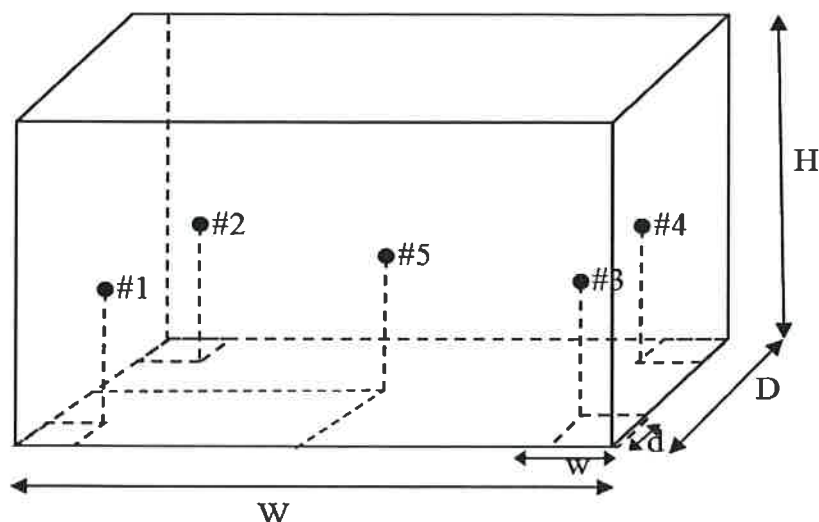
(Mr. Thalerngkeat Pong-ngarm)

Technical Management Manager

This certificate is issued the units of measurement according to the International System of Units (SI). It provides traceability of measurement to international or national standard or other recognised national standard laboratories.

The measurement uncertainty stated is the expanded uncertainty which is obtained from the standard uncertainty multiplied by the coverage factor ($k=2$) to provide a level of confidence of approximately 95%. It is determined in accordance with the Guide to Expression of Uncertainty in Measurement (GUM). The effect that the results relate only to the items calibrated.

This calibration certificate shall not be reproduced except in full only, without written approval from SPC Calibration Center Co., Ltd.



Standard Installation Locations

Midway between the diffuser plate and the water surface

Inside bath: W = 36 (cm) D = 32 (cm) H = 24 (cm) Volume = 28 (Liters)

Standard Locations #1: w = 5 (cm) d = 5 (cm)

Standard Locations #2: w = 5 (cm) d = 5 (cm)

Standard Locations #3: w = 5 (cm) d = 5 (cm)

Standard Locations #4: w = 5 (cm) d = 5 (cm)

Standard Locations #5: Center of any probes. (#1 - #4)

Position of Std	#1	#2	#3	#4	#5
Channel of Logger	1	2	3	4	5

Definitions

Indicating Temperature : The average reading of indicating device which forms the integral part of the bath.

Measured Temperature : The average reading of standards at any positions or location.

Measured Uniformity : The maximum difference of measured temperatures between of any probes and the measured temperature at the reference location which are observed at same time or at close observation time as possible to determine the temperature pattern or homogeneity with the bath at steady-state. The reference probe is preferably located in the geometric center of the bath.

Measured Stability : The one-half of greatest maximum difference of measured temperatures at any one probe.

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

Calibration Results:

Pre-Calibration

Setting: Indicating: #1: #2: #3: #4: #5:

85.0 85.0 84.00 83.90 83.92 83.92 84.03

Without adjustment

Measurement Temperature at Spread Locations, Indicating of Unit Under Calibration: 86.2 °C

Locations	Measured Temperature (°C)	Correction of UUC. (°C)	Uncertainty (± °C)
#1	85.05	-1.15	0.19
#2	84.98	-1.22	0.20
#3	84.98	-1.22	0.19
#4	84.95	-1.25	0.21
#5	85.01	-1.19	0.20

Temperature Distribution

Desired (°C)	Setting (°C)	Indicating (°C)	Measured Temperature at Spread Locations (°C)					Uncertainty (± °C)*
			#1	#2	#3	#4	#5	
85.0	86.2	86.2	85.05	84.98	84.98	84.95	85.01	0.21

Bath Characterization

Indicating (°C)	Measured Uniformity (°C)	Measured Stability (± °C)	Overall Variation (°C)
86.2	0.14	0.06	0.21

Note: * Maximum uncertainty of the each position

The End of Certificate