CALIBRATION CERTIFICATE

Issued by: **The Validation Centre (TVC) Limited**

Date of Issue: **1st September 2022** Certificate Number: **1028.22**

9361

The Validation Centre (TVC) Limited
Unit 15, Brinell Way Harfreys Industrial Estate
Great Yarmouth, Norfolk, NR31 0LU
Tel: +44 (0)1493 443800
Fax: +44 (0)1493 443900
Email: sales@tvcalx.co.uk
Web: https://www.tvcalx.co.uk

Approved signatory

☑ C. Cathles ☐ D. Goodchild ☐ K. Hastings

Customer: **Sonobotics Ltd** **Job No: 14319**

20 – 22 Wenlock Road
London
N1 7GU

GREAT BRITAIN

Description:	Ultrasonic Thickness Gauge
Manufacturer:	Sonobotics
Model:	SONUS EVO EMAT Acquisition System
Serial Number:	SON-0322211013
Asset Number:	
Calibrated Date:	1st September 2022
Calibration Due:	1st September 2023

Conditions of Test

Test Procedure WI079

Environmental Conditions:	Start of test Temperature	21.2 °C ± 3 °C
	End of test Temperature	21.6 °C ± 3 °C
	Start of test Humidity	64 %rh ± 10 %rh
	End of test Humidity	64 %rh ± 10 %rh

Stability

The results contained within this certificate refers to the results obtained at the time of test and not to the ability of the device under test to maintain its calibration.

The unit was allowed to stabilise within the Laboratory environment for a period of not less than 1 hour.

Method

The unit was calibrated in accordance with the Group 2 methods of test set out in paragraph 10 of BS EN 15317:2013. The results reported in this certificate are the on-receipt results with no adjustments having been made. The results recorded in this certificate are only applicable to the unit shown above.

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Uncertainty of Measurement

The uncertainty evaluation has been performed in accordance with ISO/IEC Guide 98-3:2008 (GUM). The reported expanded uncertainty, which corresponds to a coverage probability of approximately 95%, is the standard uncertainty multiplied by the coverage factor k=2. Where this is not the case, coverage factor (k), effective degrees of freedom (veff) and coverage probability (p) are stated.

Measurement Uncertainties

Operational Voltage	3.5%
Operational Current	3.5%
Pulse Repetition Frequency	4.1%
Pulse Voltage	3.5 %
Pulse Risetime	0.90 ns
Pulse duration	1.3 ns
Thickness	3%

Compliance with Specification

The uncertainty of measurement has been considered when determining compliance with specification, as per ILAC-G8:09/2019. If the expanded measurement uncertainty intervals centred about one or more measured values were both in as well as out of specification (upper or lower), it is not possible to state compliance or non-compliance based on a 95% coverage probability in the expanded measurement uncertainty.

An overall statement of compliance for all tests performed as received, and as completed (if any adjustments / repairs were performed) is included on page 4 of this report. Statements of compliance apply only to warranted specification. When functional verification tests are performed, results are reported in the 'Results' section and do not affect these statements of compliance. The status summaries relate to the tested items only. A final decision about whether the items performance actually satisfies requirements of the user can only be made by the user.

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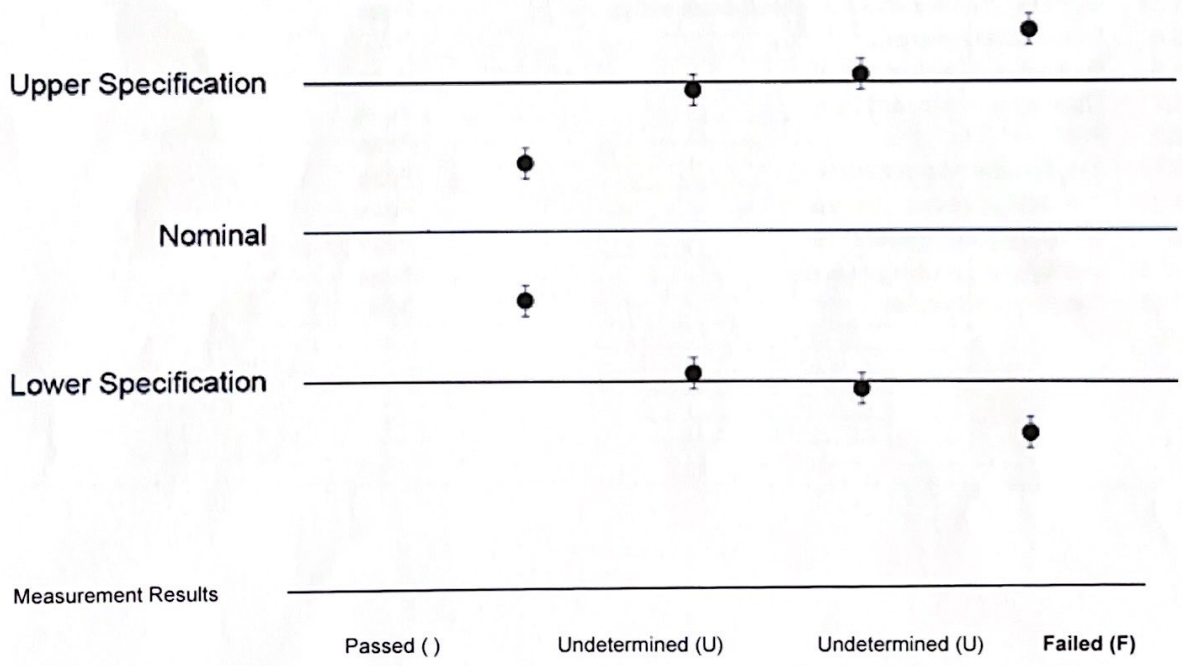
Measurement results are reported as:

- Passed ( ) - The measured values of the equipment were observed in specification at the points tested. Additionally, the expanded measurement uncertainty intervals about the measured values were in specification.
- Undetermined (U) - The expanded measurement uncertainty intervals about one or more measured values were in as well as out of specification. Consequently, neither compliance nor non-compliance with specification can be declared based on the stated coverage factor.
- Failed (F) - One or more measured values of the equipment were observed out of specification at the points tested. Additionally, the expanded measurement uncertainty intervals about one or more measured values were entirely outside the specification.



( ) This result is indicated on the measurement report as a blank space in the column labelled Status' or 'Sts'.

MU = 95% expanded measurement uncertainty.

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Acceptance Limit

The 'TVC Cal + Uncertainties + Guardbanding' service employs a guard band in the amount of 95% expanded measurement uncertainty (MU). The resulting acceptance limit applied for Pass or Fail decisions, and for performing adjustments, is the difference of the specification and the guard band. It should be noted that the unit can fail the visual inspection test if there is damage observed which could affect the correct operation of the unit.

RESULTS SUMMARY

The Ultrasonic Test Set was tested to BS EN 15317:2013 and the following results obtained.

BS EN ISO 15317:2013

Para.	Title	Result
10.4	General mechanical state and external aspects	Pass
9.4	Low battery warning	N/A
9.6	Operational voltage range	Pass
9.7	Operational current range	Pass
9.9	PRF	Pass
9.10	Transmitter parameters	Pass
9.12	Thickness measurement	Pass
9.13	Accuracy and resolution	Pass
9.16	Calibration setting storage	Pass
9.19	Display and recall	N/A

RESULTS

10.4 General Mechanical State	Checked	Remark	Status
General Condition	Satisfactory		
Case	Satisfactory		
Controls	Satisfactory		
Connectors	Satisfactory		
Probe Cable	Satisfactory		
Probe (Wear shoe, body)	Satisfactory		

General Characteristics			Remark	Status
9.4	Low Battery Warning	N/A		
9.6	Operational Voltage Range Max (V)	11.8		
9.6	Operational Voltage Range Min (V)	7.7		
9.7	Operational Current Range Max (mA)	774.0		
9.7	Operational Currant Range Min (mA)	566.0		

Transmitter			Remark	Status
9.9	PRF (Hz)	495		
9.10	Amplitude (V)	477.0		
	Rise Time (ns)	2.9		
	Duration (Pulse Width ns)	645.0		
	Reverberation (V)	0.0		

Performance			Remark	Status
9.12 Maximum Thickness	2.00	**mm**		
9.12 Minimum Thickness	100.00	**mm**		

9.13 Accuracy and Resolution			Remark	Status
TVC099 2.21 mm	2.18	**mm**		
TVC089 3.00 mm	3.01	**mm**		
TVC089 4.99 mm	5.02	**mm**		
TVC089 9.99 mm	10.01	**mm**		
TVC014 19.986 mm	19.96	**mm**		
TVC015 50.006 mm	50.06	**mm**		
TVC015 74.966 mm	74.98	**mm**		
TVC176 99.987 mm	99.99	**mm**		

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Certificate Number
1128.22

Unit Serial No. SON-0322211013

RESULTS

9.16 Calibration setting storage			Remark	Status
Instrument shut down				
TVC099 2.21 mm	2.18	mm		
TVC089 3.00 mm	3.00	mm		
TVC089 4.99 mm	5.01	mm		
TVC089 9.99 mm	10.00	mm		
TVC014 19.986 mm	19.96	mm		
TVC015 50.006 mm	50.05	mm		
TVC015 74.966 mm	74.98	mm		
TVC176 99.987 mm	99.99	mm		

9.16 Calibration setting storage			Remark	Status
Automatic Shut Down				
TVC099 2.21 mm	N/A	mm		
TVC089 3.00 mm	N/A	mm		
TVC089 4.99 mm	N/A	mm		
TVC089 9.99 mm	N/A	mm		
TVC014 19.986 mm	N/A	mm		
TVC015 50.006 mm	N/A	mm		
TVC015 74.966 mm	N/A	mm		
TVC176 99.987 mm	N/A	mm		

9.16 Calibration setting storage			Remark	Status
Battery Disconnection				
TVC099 2.21 mm	2.18	mm		
TVC089 3.00 mm	3.01	mm		
TVC089 4.99 mm	5.02	mm		
TVC089 9.99 mm	10.01	mm		
TVC014 19.986 mm	19.96	mm		
TVC015 50.006 mm	50.03	mm		
TVC015 74.966 mm	74.99	mm		
TVC176 99.987 mm	99.98	mm		

9.16 Calibration setting storage			Remark	Status
9.19 Display and recall				
TVC099 2.21 mm	N/A	mm		
TVC089 3.00 mm	N/A	mm		
TVC089 4.99 mm	N/A	mm		
TVC089 9.99 mm	N/A	mm		
TVC014 19.986 mm	N/A	mm		
TVC015 50.006 mm	N/A	mm		
TVC015 74.966 mm	N/A	mm		
TVC176 99.987 mm	N/A	mm		

The results reported in this certificate are the on receipt results with no adjustment having been made.

Calibrated by David Goodchild

Signed

Date 01-Sep-22

END