

CUSTOMER

Name: AV Consulting Calibration Laboratory
Address: Benedenberg 100A
Zip code & City : 2861 LH
Country: Nederland

CALIBRATION OF

Device: Microphone Measuring Amplifier
Brand & type: Bruel & Kjaer NEXUS 2691-OS2
Serial number: 2561913
Customers Instrument tag: AV005

SPECIFICATIONS

Calibrated in accordance with: The guiding document for requirements relating to in-house calibration activities is ISO/IEC 17025 - General Requirements for the Competence of Calibration and Testing Laboratories.
Method used: Calibrated in accordance with the requirements as specified by vendor,
Traceability: The calibration assures the traceability to the international units system SI.

CALIBRATION CONDITIONS

Preconditioning: 4 hours at 23 [°C] ± 3 [°C]
Environmental conditions: Pressure Unit Humidity Unit Temperature Unit
1021,90 [hPa] 48,0 [%] 23,2 [°C]

UNCERTAINTY OF MEASUREMENT

The reported expanded uncertainty is based on a standard uncertainty multiplied by a coverage factor $k = 2$, which for a normal distribution provides a level of confidence of approximately 95%. The uncertainty evaluation has been carried out in accordance with EA-4/02 from elements originating from standards, calibration method, effects of environmental conditions and any short time contribution from the device under calibration.

RESULT

PASS

DATE

Date of calibration:

Date of issue:

Calibration Engineer:

Approved Signatory:

A.Vreeswijk

9-Nov-2017

9-Nov-2017

AV-Consulting Calibration
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Reproductie van het volledige certificaat is toegestaan. Gedeelten van het certificaat mogen slechts worden gereproduceerd na verkregen schriftelijke toestemming van het laboratorium van afgifte. Dit certificaat wordt verstrekt onder het voorbehoud dat AV-Consulting Calibration Laboratory generlei aansprakelijkheid aanvaardt.

VISUAL INSPECTION

	Yes	No
The equipment / device is in serviceable condition.	x	
There is no visible damage.	x	
The appropriate documentation accompanied the equipment.	x	
Calibration tags / CE tags are present and correct.	x	
The equipment is suitable to use for official testing and/or calibration.	x	

COMMENTS

The instrument submitted for testing successfully completed the periodic tests in accordance with the requirements as specified by vendor, for the environmental conditions under which the tests were performed. The tests demonstrate that the instrument fully conformed according to the specifications as specified by vendor.
No adjustments have been made to the instrument.
Distortion: Measured is the Total Harmonic Distortion (THD) 2 Hz to 22,4 kHz

CALIBRATION EQUIPMENT

Device	Brand	Type	Serial no.
Digital Voltmeter 6½ digits	Keysight	34465A	MY54502281
Arbitrary Waveform Generator	BK Precision	4052	388114141
ICP Source follower	PCB	401B04	856
Electroacoustical Calibrator	Bruel & Kjaer	4231	1000577
Pistonphone	Bruel & Kjaer	4228	1570765
Mulifrequency Calibrator	Bruel & Kjaer	4226	1854566
Calibration Capacitor	Kistler	5371A1000	
Microphone replacement	NTI	K65-15	K65S
Ultra Low Distortion Generator	Stanford RS	DS360	33264
Puls FFT-Analyzing System	Bruel & Kjaer	3032A	2338570
Audio analyzer	NTI	XL2	A2A-06359-E0

DEVICE UNDER TEST

Device	Type	Brand	Serial no.
Measuring amplifier	NEXUS 2691-OS2	Bruel & Kjaer	2561913
Signal input type	ZX2691 - AO-0479	Bruel & Kjaer	
Pre-amplifier /	N/A	N/A	
Supplied calibrator	AV005	N/A	
Software version	01_01_00	Bruel & Kjaer	
Instruction manual	BE1522-13	Bruel & Kjaer	
Pattern approval	N/A	N/A	

MEASUREMENTS & TESTS AS SPECIFIED BY VENDOR

0. PRELIMINARY INSPECTION

Prior to any measurements the sound level meter and all accessories and controls etc. shall be visually checked. All relevant controls shall be operated to ensure proper working. If controls, display or other essential elements are not proper working no tests shall be performed.

	Battery Leakage	Input connectors	Controls	Display	Accessories	Other elements
Visual inspection Proper working order	OK	OK	OK	OK	OK	OK

1. ENVIRONMENTAL CONDITIONS DURING CALIBRATION

Actual environmental conditions prior to calibration.

Prior to calibration	Measured	Unit
Barometric pressure	1021,9	[hPa]
Relative humidity	48,0	[%]
Air temperature	23,2	[°C]

Actual environmental conditions after calibration.

After calibration	Measured	Unit
Barometric pressure	1022.1	[hPa]
Relative humidity	48,0	[%]
Air temperature	23,0	[°C]

2. REFERENCE INFORMATION

Information about reference range, level and channel.

Configuration	Type
Channel 1	Preamp ZX2691
Channel 2	Preamp ZX2691

3. RESULTS

The instrument has been calibrated in accordance with the requirements as specified by vendor, using calibration procedure in accordance with the in-house calibration procedure.

CHANNEL 1

All measurements made non floating on input and output.

Transducer sensitivity : 1 V/Pa (0 dB Gain)

Calibrated output:

The gain from input to calibrated output, is calculated as measured output level, relative to measured input level in dB. Levels are measured by means of a DMM.

Output bandwidth limited with external 22.4 kHz LP filter.

Generator frequency: 1 kHz

Nexus: HP 20 Hz LP 100 kHz

Nexus setting	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
100mV/Pa	134 dBuV	dB	87,88	88,07	88,01	0,01
3 16mV/ Pa	134 dBuV	dB	97,89	98,09	98,02	0,01
1 V/Pa	125 dBuV	dB	98,88	99,08	99,03	0,01
3.16 V/Pa	115 dBuV	dB	98,87	99,07	98,98	0,01
10 V/Pa	105 dBuV	dB	98,88	99,08	99,02	0,01
31.6 V/Pa	95 dBuV	dB	98,87	99,07	99,02	0,01
100 V/Pa	85 dBuV	dB	98,88	99,07	99,02	0,01
316 V/Pa	75 dBuV	dB	98,87	99,07	99,02	0,01
1kV/Pa	74 dBuV	dB	107,88	108,08	108,02	0,01
3.16 kV/Pa	64 dBuV	dB	107,87	108,07	108,02	0,01

Low-pass filters:

The frequency response of Low-pass filters is calculated as measured output level relative to measured input level in dB. Levels are measured by means of a DMM.

Input Level: 120 dBuV (1 Volt)

Nexus: Sens. 1 V/Pa (0 dB Gain) HP 0.1 Hz

Nexus setting	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
LP 0,1 kHz	20 Hz	dB	-0,10	0,10	0,00	0,01
LP 0,1 kHz	100 Hz	dB	-1,40	-0,60	-0,93	0,04
LP 1 kHz	200 Hz	dB	-0,10	0,10	0,01	0,01
LP 1 kHz	1000 Hz	dB	-1,40	-0,60	-0,98	0,04
LP 3 kHz	600 Hz	dB	-0,10	0,10	0,01	0,01
LP 3 kHz	3000 Hz	dB	-1,40	-0,60	-1,00	0,04
LP 10 kHz	2000 Hz	dB	-0,10	0,10	0,00	0,01
LP 10 kHz	10000 Hz	dB	-1,40	-0,60	-0,89	0,04
LP 22,4 kHz	4480 Hz	dB	-0,10	0,10	0,01	0,01
LP 22,4 kHz	22400 Hz	dB	-1,40	-0,60	-0,98	0,04
LP 30 kHz	6000 Hz	dB	-0,10	0,10	0,00	0,01
LP 30 kHz	30000 Hz	dB	-1,40	-0,60	-1,02	0,04
LP 100 kHz	20000 Hz	dB	-0,10	0,10	-0,02	0,01
LP 100 kHz	60000 Hz	dB	-0,40	0,40	0,00	0,04
LP 100 kHz	100000 Hz	dB	-1,80	-0,20	-1,24	0,08

High-pass filters:

The frequency response of High-pass filters is calculated as measured output level relative to measured input level in dB. Levels are measured by means of a DMM.

Input Level: 120 dBuV (1 Volt)

Nexus: Sens. 1 V/Pa (0 dB Gain) LP 100 kHz

Nexus setting	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
HP 0,1 Hz	0,1 Hz	dB	-1,40	-0,60	-1,05	0,05
HP 0,1 Hz	0,5 Hz	dB	-0,10	0,10	0,00	0,05
HP 20 Hz	20,0 Hz	dB	-1,40	-0,60	-1,24	0,05
HP 20 Hz	100 Hz	dB	-0,10	0,10	0,00	0,01

A filter:

The frequency response of Low-pass filters is calculated as measured output level relative to measured input level in dB. Levels are measured by means of a DMM.

Nexus: Sens. 1 V/Pa (0 dB Gain) A-filter

Frequency	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
20 Hz	130 dBuV	dB	-52,50	-48,50	-50,05	0,01
39,8 Hz	120 dBuV	dB	-35,60	-33,60	-34,62	0,01
100 Hz	120 dBuV	dB	-19,80	-18,40	-19,08	0,01
1000 Hz	120 dBuV	dB	-0,70	0,70	0,00	0,01
2512 Hz	120 dBuV	dB	0,60	2,00	1,30	0,01
3981 Hz	120 dBuV	dB	0,30	1,70	0,00	0,01
10000 Hz	120 dBuV	dB	-3,20	-1,80	-2,45	0,01
19950 Hz	120 dBuV	dB	-10,00	-8,60	-9,28	0,01

Inherent noise & generator:

The Inherent Noise is measured by connecting a short-circuit plug to the input, and measuring the output level by means of a DMM.

Nexus: Sens. 31,6kV/Pa (90dB Gain) HP 100 kHz LP 100kHz

Parameter	Unit	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
A-weighted	μV	N/A	2,00	1,55	0,05
Reference generator: Tone	dB 20uPa	93,88	94,08	93,98	0,05

Distortion:

Generator signal: 127 dBuV (2.24 Volt) 1 kHz

Nexus: Sens. 1 V/Pa (0 dB Gain) HP 0,1Hz LP30kHz

Parameter	Unit	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
Distortion (THD)	%	N/A	0,0100	0,00000	0,05

CHANNEL 2

All measurements made non floating on input and output.

Transducer sensitivity : 1 V/Pa (0 dB Gain)

Calibrated output: Channel 2

The gain from input to calibrated output, is calculated as measured output level, relative to measured input level in dB. Levels are measured by means of a DMM.

Output bandwidth limited with external 22.4 kHz LP filter.

Generator frequency: 1 kHz

Nexus: HP 20 Hz -P 100 kHz

Nexus setting	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
100mV/Pa	134 dBuV	dB	87,88	88,07	87,99	0,01
3 16mV/ Pa	134 dBuV	dB	97,89	98,09	97,98	0,01
1 V/Pa	125 dBuV	dB	98,88	99,08	98,98	0,01
3.16 V/Pa	115 dBuV	dB	98,87	99,07	99,03	0,01
10 V/Pa	105 dBuV	dB	98,88	99,08	98,98	0,01
31.6 V/Pa	95 dBuV	dB	98,87	99,07	99,02	0,01
100 V/Pa	85 dBuV	dB	98,88	99,07	99,03	0,01
316 V/Pa	75 dBuV	dB	98,87	99,07	99,02	0,01
1kV/Pa	74 dBuV	dB	107,88	108,08	108,04	0,01
3.16 kV/Pa	64 dBuV	dB	107,87	108,07	108,02	0,01

Low-pass filters:

The frequency response of Low-pass filters is calculated as measured output level relative to measured input level in dB. Levels are measured by means of a DMM.

Input Level: 120 dBuV (1 Volt)

Nexus: Sens. 1 V/Pa (0 dB Gain) HP 0.1 Hz

Nexus setting	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
LP 0,1 kHz	20 Hz	dB	-0,10	0,10	0,00	0,01
LP 0,1 kHz	100 Hz	dB	-1,40	-0,60	-0,95	0,04
LP 1 kHz	200 Hz	dB	-0,10	0,10	0,01	0,01
LP 1 kHz	1000 Hz	dB	-1,40	-0,60	-0,97	0,04
LP 3 kHz	600 Hz	dB	-0,10	0,10	0,01	0,01
LP 3 kHz	3000 Hz	dB	-1,40	-0,60	-1,00	0,04
LP 10 kHz	2000 Hz	dB	-0,10	0,10	0,00	0,01
LP 10 kHz	10000 Hz	dB	-1,40	-0,60	-0,89	0,04
LP 22,4 kHz	4480 Hz	dB	-0,10	0,10	0,01	0,01
LP 22,4 kHz	22400 Hz	dB	-1,40	-0,60	-0,98	0,04
LP 30 kHz	6000 Hz	dB	-0,10	0,10	0,02	0,01
LP 30 kHz	30000 Hz	dB	-1,40	-0,60	-1,02	0,04
LP 100 kHz	20000 Hz	dB	-0,10	0,10	-0,02	0,01
LP 100 kHz	60000 Hz	dB	-0,40	0,40	0,01	0,04
LP 100 kHz	100000 Hz	dB	-1,80	-0,20	-1,24	0,08

High-pass filters:

The frequency response of High-pass filters is calculated as measured output level relative to measured input level in dB. Levels are measured by means of a DMM.

Input Level: 120 dBuV (1 Volt)
 Nexus: Sens. 1 V/Pa (0 dB Gain) LP 100 kHz

Nexus setting	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
HP 0,1 Hz	0,1 Hz	dB	-1,40	-0,60	-1,25	0,05
HP 0,1 Hz	0,5 Hz	dB	-0,10	0,10	0,00	0,05
HP 20 Hz	20,0 Hz	dB	-1,40	-0,60	-1,24	0,05
HP 20 Hz	100 Hz	dB	-0,10	0,10	0,00	0,01

A filter:

The frequency response of Low-pass filters is calculated as measured output level relative to measured input level in dB. Levels are measured by means of a DMM.

Nexus: Sens. 1 V/Pa (0 dB Gain) A-filter

Frequency	Input Level	Unit dB ref. 20uPa	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
20 Hz	130 dBuV	dB	-52,50	-48,50	-50,01	0,01
39,8 Hz	120 dBuV	dB	-35,60	-33,60	-34,58	0,01
100 Hz	120 dBuV	dB	-19,80	-18,40	-19,17	0,01
1000 Hz	120 dBuV	dB	-0,70	0,70	0,01	0,01
2512 Hz	120 dBuV	dB	0,60	2,00	1,30	0,01
3981 Hz	120 dBuV	dB	0,30	1,70	0,00	0,01
10000 Hz	120 dBuV	dB	-3,20	-1,80	-2,45	0,01
19950 Hz	120 dBuV	dB	-10,00	-8,60	-9,28	0,01

Inherent noise & generator:

The Inherent Noise is measured by connecting a short-circuit plug to the input, and measuring the output level by means of a DMM.

Nexus: Sens. 31,6kV/Pa (90dB Gain) HP 100 kHz LP 100kHz

Parameter	Unit	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
A-weighted	μV	N/A	2,00	1,65	0,05
Reference generator: Tone	dB 20uPa	93,88	94,08	94,00	0,05

Distortion:

Generator signal: 127 dBuV (2.24 Volt) 1 kHz
 Nexus: Sens. 1 V/Pa (0 dB Gain) HP 0,1Hz LP30kHz

Parameter	Unit	Lower Limit	Upper Limit	Measured	Calibration Uncertainty
Distortion (THD)	%	N/A	0,0100	0,00400	0,05