



Calibration and Measurement Capabilities of PTB in the field of Acoustics, Ultrasound and Vibration

In this document the calibration and measurement capabilities are documented which PTB offers as a world-wide service. A part of these capabilities is listed in the calibration and measurement capabilities (CMC) tables of the Bureau International de Poids et Mesures (BIPM) and offers them under the auspice of the Mutual Recognition Arrangement (MRA). All CMCs can be found at the BIPM website <https://kcdb.bipm.org/appendixC/default.asp>.

Metrology area:		Acoustics, Ultrasound and Vibration (AUV)	
Branch:		Sound in Air	
Measurement Quantity	Measurand level or range	Uncertainty	CMC-entry
Pressure sensitivity level of measurement microphones (LS1P)	2 Hz – 10 kHz	0,03 dB to 0,23 dB	yes
Pressure sensitivity level of measurement microphones (LS2P)	31,5 Hz – 20 kHz	0,04 dB to 0,13 dB	yes
Mechanical impedance of artificial mastoids	125 Hz – 8 kHz	0,4 dB	no
Force sensitivity level of artificial mastoids	125 Hz – 4 kHz	0,4 dB	yes
Sound pressure level of sound calibrators (LS1P)	250 Hz, 1 kHz	0,05 dB	yes
Sound pressure level of sound calibrators (LS2P)	250 Hz, 1 kHz	0,06 dB	yes
Sound pressure level of multi-frequency sound calibrators	31,5 Hz – 16 kHz	0,1 dB to 0,25 dB	yes
Free-field sensitivity level of measurement microphones	25 Hz – 31,5 Hz	0,3 dB	no
Free-field sensitivity level of measurement microphones	31,5 Hz - 12,5 kHz	0,2 to 0,4 dB	yes
Free-field sensitivity level of measurement microphones	12,5 kHz – 20 kHz	0,4 dB	no
Pressure sensitivity level of measurement microphones (WS2P, Simultaneous comparison)	125 Hz – 16 kHz	0,1 dB to 0,25 dB	no
Pressure sensitivity level of measurement microphones (WS1P, Sequential comparison)	125 Hz – 8 kHz	0,1 dB to 0,25 dB	no
Directivity of microphones	500 Hz – 12,5 kHz	0,2 to 1,4 dB	no
Free-field response level of sound level meters	25 Hz – 31,5 Hz	0,4 dB	no
Free-field response level of sound level meters	31,5 Hz – 12,5 kHz	0,2 to 0,5 dB	yes
Free-field response level of sound level meters	12,5 kHz – 20 kHz	0,5 dB	no
Calibration of reference sound sources, hemianechoic room	100 Hz – 20 kHz	0,6 dB (1 kHz)	no
Calibration of reference sound sources, reverberation room	100 Hz – 10 kHz	0,6 dB (1 kHz)	no



Metrology area:		Acoustics, Ultrasound and Vibration (AUV)	
Branch:		Ultrasound	
Measurement Quantity	Measurand level or range	Uncertainty	CMC-entry
Ultrasonic power	0,002 W – 20 W 1 MHz – 5 MHz	3 %	yes
Ultrasonic power	0,002 W – 3 W 5 MHz – 11 MHz	3 % to 5 %	yes
Ultrasonic power	0,002 W – 0,5 W 11 MHz – 21 MHz	5 % to 12 %	yes
Ultrasonic power (high intensity focused fields for therapy)	5 W – 150 W 0,75 MHz – 5 MHz	3 % to 8 %	yes
Ultrasonic power (high intensity focused fields for therapy)	150 W – 500 W 0,75 MHz – 5 MHz	8 % to 10 %	no
Free-field sensitivity of Hydrophones (Interferometry, primary)	0,5 MHz – 20 MHz	6 % to 8 %	yes
Free-field sensitivity of Hydrophones (Interferometry, primary)	20 MHz – 50 MHz	8 % to 12 %	no
Free-field sensitivity of Hydrophones (Substitution)	0,5 MHz – 1 MHz	14 %	yes
Free-field sensitivity of Hydrophones (Substitution)	1 MHz – 20 MHz	9 % to 11 %	yes
Free-field sensitivity of Hydrophones (Substitution)	20 MHz – 50 MHz	8 % to 15 %	no
Ultrasonic pressure (Hydrophone field measurement)	1 MHz – 15 MHz	9 % to 12 %	no
Derived ultrasonic intensity (Hydrophone field measurement)	1 MHz – 15 MHz	18 % to 30 %	no
Ultrasonic beam dimensions (Hydrophone field measurement)	1 MHz – 15 MHz	10 % to 35 %	no

Metrology area:		Acoustics, Ultrasound and Vibration (AUV)	
Branch:		Vibration	
Measurement Quantity	Measurand level or range	Uncertainty	CMC-entry
Acceleration (sine), laser vibrometer	0,001 m/s ² to 100 m/s ² 0,4 Hz to 10 kHz	0,1 %	yes
Acceleration (sine), laser vibrometer	0,001 m/s ² to 100 m/s ² > 10 kHz to 20 kHz	0,2 %	yes
Acceleration (sine), Accelerometer	0,001 m/s ² to 100 m/s ² 0,4 Hz to < 10 Hz	0,2 %	yes
Acceleration (sine), Accelerometer	0,001 m/s ² to 100 m/s ² 10 Hz to 5 kHz	0,1 %	yes
Acceleration (sine), Accelerometer	0,001 m/s ² to 100 m/s ² > 5 kHz to 10 kHz	0,3 %	yes
Acceleration (sine), Accelerometer	0,001 m/s ² to 100 m/s ² > 10 kHz to 15 kHz	0,5 %	yes
Acceleration (sine), Accelerometer	0,001 m/s ² to 100 m/s ² > 15 kHz to 20 kHz	1 %	yes



Metrology area:		Acoustics, Ultrasound and Vibration (AUV)	
Branch:		Vibration	
Measurement Quantity	Measurand level or range	Uncertainty	CMC-entry
Acceleration (Push, magnitude)	50 m/s ² to 10000 m/s ² 0,3 ms to 10 ms	0,5 %	yes
Acceleration (Push, magnitude)	> 10000 m/s ² to 100000 m/s ² 0,08 ms to 0,3 ms	1 %	yes
Acceleration (magnitude), Acceleration measuring instrument	10 m/s ² to 800 m/s ² 0,4 Hz to 1 kHz	0,3 %	yes
Acceleration (magnitude), Acceleration measuring instrument	10 m/s ² to 800 m/s ² > 1 kHz to 5 kHz	0,5 %	yes
Acceleration (magnitude, Calibrator)	10 m/s ² to 800 m/s ² 0,4 Hz to 1 kHz	0,3 %	yes
Acceleration (magnitude, Calibrator)	10 m/s ² to 800 m/s ² > 1 kHz to 5 kHz	0,5 %	yes
Charge sensitivity (magnitude), Accelerometer	0,4 Hz to < 10 Hz	0,2 %	yes
Charge sensitivity (magnitude), Accelerometer	10 Hz to 5 kHz	0,1 %	yes
Charge sensitivity (magnitude), Angular accelerometer	0,4 Hz to 160 Hz	0,3 %	yes
Charge sensitivity (magnitude), Angular accelerometer	> 160 Hz to 1 kHz	0,5 %	yes
Charge sensitivity (magnitude), Accelerometer	0,4 Hz to 1 kHz	0,3 %	yes
Charge sensitivity (magnitude), Accelerometer	> 1 kHz to 5 kHz	0,5 %	yes
Charge sensitivity (magnitude), Accelerometer	> 5 kHz to 10 kHz	0,3 %	yes
Charge sensitivity (magnitude), Accelerometer	> 10 kHz to 15 kHz	0,5 %	yes
Charge sensitivity (magnitude), Accelerometer	> 15 kHz to 20 kHz	1 %	yes
Charge sensitivity (phase), Accelerometer	0° to 360° 0,4 Hz to 1 kHz	0,2°	yes
Charge sensitivity (phase), Accelerometer	0° to 360° > 1 kHz to 10 kHz	0,5°	yes
Charge sensitivity (phase), Angular accelerometer	0° to 360° 0,4 Hz to 1 kHz	0,5°	yes
Charge sensitivity (phase), Accelerometer	0° to 360° 0,4 Hz to 1 kHz	0,5°	yes
Charge sensitivity (phase), Accelerometer	0° to 360° > 1 kHz to 5 kHz	1°	yes
Voltage sensitivity (phase), Angular acceleration measuring chain	0° to 360° 0,4 Hz to 1 kHz	0,5°	yes
Voltage sensitivity Acceleration measuring chain	0° to 360° > 1 kHz to 10 kHz	0,2°	yes
Voltage sensitivity Acceleration measuring chain	0° to 360° 0,4 Hz to 1 kHz	0,2°	yes
Voltage sensitivity (phase), Acceleration measuring chain	0° to 360° 0,4 Hz to 160 Hz	1°	yes



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Measurement Quantity	Measurand level or range	Uncertainty	CMC-entry
Voltage sensitivity (phase), Acceleration measuring chain	0° to 360° > 1 kHz to 5 kHz	1°	yes
Voltage sensitivity (phase), Angular acceleration measuring chain	0° to 360° 0,4 Hz to 160 Hz	1°	yes
Voltage sensitivity (magnitude), Angular acceleration measuring chain	0,4 Hz to 160 Hz	0,5 %	yes
Voltage sensitivity (magnitude), Angular acceleration measuring chain	> 160 Hz to 1 kHz	0,5 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	0,4 Hz to 1 kHz	0,3 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	> 1 kHz to 5 kHz	0,5 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	0,4 Hz to < 10 Hz	0,2 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	10 Hz to 5 kHz	0,1 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	> 10 kHz to 15 kHz	0,5 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	> 5 kHz to 10 kHz	0,3 %	yes
Voltage sensitivity (magnitude), Acceleration measuring chain	> 15 kHz to 20 kHz	1 %	yes
Shock sensitivity (Voltage)	50 m/s ² to 10000 m/s ² 0,3 ms to 10 ms	0,5 %	yes
Shock sensitivity (Voltage), PK ¹ , BA ²	>10000 m/s ² to 100000 m/s ² 0,08 ms to 0,3 ms	1 %	yes
Shock sensitivity (Charge, magnitude)	50 m/s ² to 10000 m/s ² 0,3 ms to 10 ms	0,5 %	yes
Shock sensitivity (Charge, magnitude), PK ¹ , BA ²	>10000 m/s ² to 100000 m/s ² 0,08 ms to 0,3 ms	1 %	yes
Angular acceleration (sine)	1 rad/s ² to 1400 rad/s ² > 160 Hz to 1 kHz	0,5 %	yes
Angular acceleration (sine)	1 rad/s ² to 1400 rad/s ² 0,4 Hz to 160 Hz	0,3 %	yes
Angular acceleration (magnitude)	10 rad/s ² to 1000 rad/s ² 0,5 Hz to 160 Hz	0,5 %	yes
Angular acceleration (magnitude, Calibrator)	10 rad/s ² to 1000 rad/s ² 0,5 Hz to 160 Hz	0,5 %	yes