



Calibration of Audiometers with SLM Type 2235

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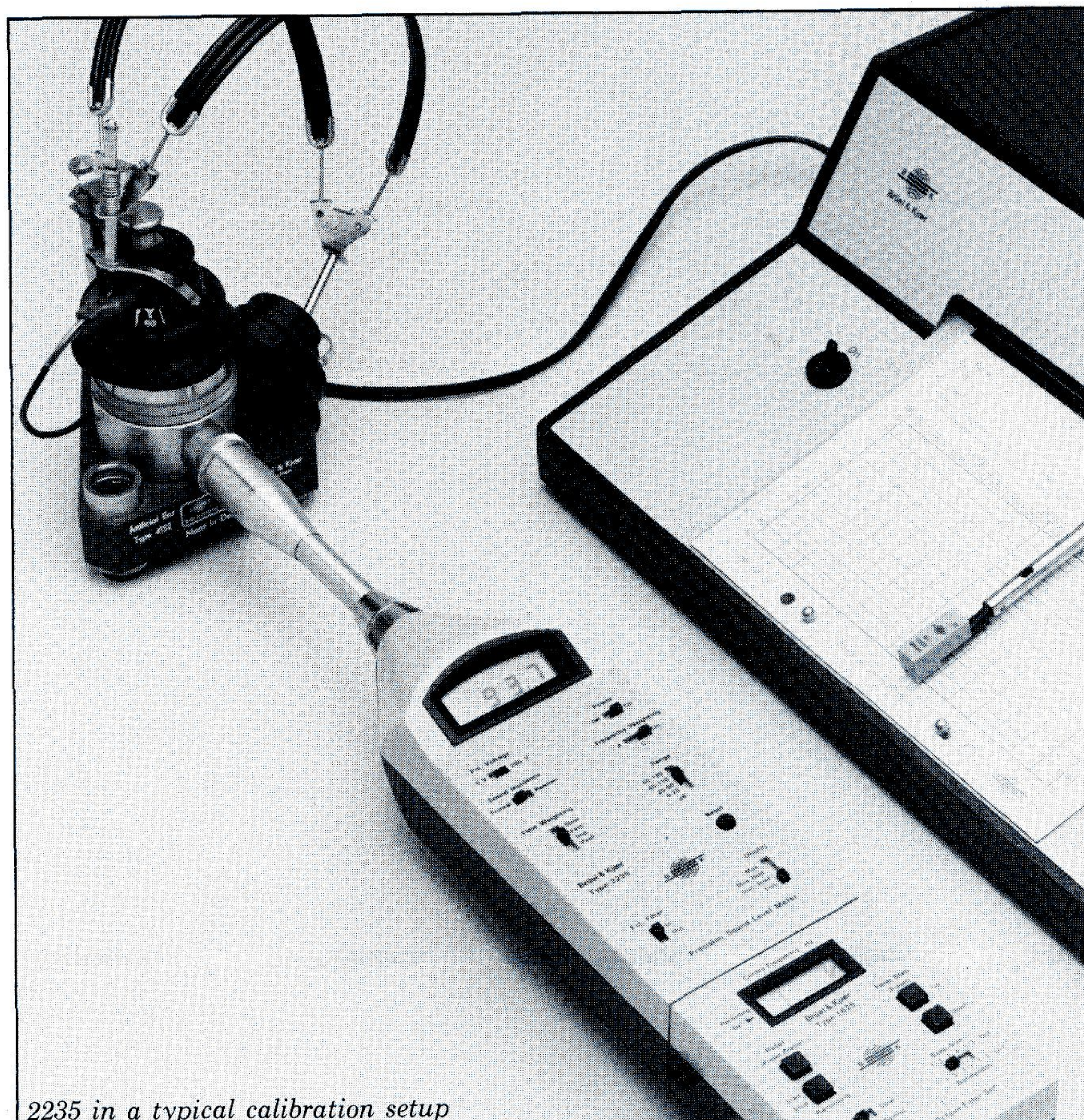
Introduction

Wherever Audiometers are used for screening the hearing threshold of individuals it is recommended that the equipment be subjected to a weekly or daily calibration check. For this purpose the sound pressure level of the "hearing levels" can be measured using the Sound Level Meter Type 2235 (2231) together with a Pressure Microphone Type 4144 and Artificial Ear Type 4152.

The following procedure describes how to assess the Sound Pressure Level in the Artificial Ear. For the actual calibration of the Audiometer, refer to the Audiometer and Artificial Ear Instruction Manuals.

Instrumentation

Sound Level Meter	Type 2235
or Prec. SLM	(Type 2231)
Octave Filter	Type 1625
Adaptor	Type DB 0375
Microphone	Type 4144
Artificial Ear	Type 4152
Calibrator	Type 4230
or Pistonphone	(Type 4220)
Audiometer	e.g. Type 1800



2235 in a typical calibration setup

Handling

1. Mount the Adaptor DB 0375 onto the input connector of the Artificial Ear. Only a loose fit is required at this stage.
2. Remove the Input Stage ZC0020 from the Sound Level Meter, unscrew the Microphone Type 4176 from the Input Stage, and screw the Input Stage onto the Adaptor DB 0375.
3. Connect the Sound Level Meter to its Input Stage. When the complete assembly is correctly orientated, tighten the retaining rings with a light finger torque.
4. Gently screw Microphone Type 4144 onto Artificial Ear.
5. Set **Pol Voltage** to "200" and **Sound Incidence** to "Frontal". Fit the Sound Level Calibrator over the microphone and calibrate the Sound Level Meter as described in section 2.4 of its Instruction Manual, but with a reference level of 94 dB as the microphone has a linear pressure response.
6. Remount acoustic coupler DB 0909 and position the earphone according to the Instruction Manual for the Artificial Ear.
7. The Sound Level Meter is now ready to display the SPL produced by the earphones in the Artificial Ear.
9. Table 1 shows the actual levels for the earphone TDH 49 (ISO 389) to obtain at the different frequencies:

Frequency Hz	DB 0909 (4152) Coupler SPL dB	(4153) Coupler SPL dB	Microphone corr. dB *)	SPL Reading dB	Tolerance dB
500	103,5	103,5			± 2
1000	97,0	98,0			± 2
2000	101,0	100,5			± 2
3000	99,5	101,5			± 2
4000	100,5	103,5			± 3
6000	103,5	103,5			± 3
8000	103,0	106,0			± 4

*) Read from microphone calibration chart and add to Coupler SPL to get SPL Reading
Example: at 8 kHz, microphone has -1,7 dB; SPL Reading becomes 103,0 - 1,7 dB = 101,3 dB

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Table 1. Sound Pressure Level Readings on Sound Level Meter and Absolute Sound Pressure Level at the different test frequencies

Test of the background noise in the booth:

The patient can be disturbed and thus the test be affected by the background noise. Therefore the background noise in the booth should be measured and analysed to prevent false results of hearing threshold measurements. The recommended limits of background levels are shown in Table 2:

In Table 3 values are calculated for octave bands, therefore the spread of the levels. Also the corrections for the sound isolating cushions UA 0520 are shown.

Third-Octave Band f_0 Hz	L_p dB, re 20 μ Pa
31.5	78
40	73
50	68
63	64
80	50
100	55
125	51
160	47
200	42
250	37
315	33
400	24
500	18
630	18
800	20
1000	23
1250	25
1600	27
2000	32
2500	35
3150	38
4000	40
5000	38
6300	36
8000	39

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Table 2. Recommended limits of background levels

Oktavband f_0 Hz	L_p dB re μ Pa	$L_p \omega$ UA 0520 dB re 20 μ Pa
31,5	73 - 80	73 - 80
63	59 - 70	59 - 70
125	47 - 57	~ (56 - 66)
250	33 - 44	~ (46 - 57)
500	18 - 26	30 - 40
1000	20 - 28	42 - 28
2000	27 - 37	48 - 53
4000	38 - 44	54 - 60
8000	36 - 41	43 - 49

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Table 3. Recommended limits of background levels calculated for octave bands and corrections for sound isolating cushions UA 0520