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Cinematography — Method of measurement of perceived loudness of motion-picture audio material

Cinématographie — Méthode de mesure de l'intensité sonore perçue pour les films cinématographiques

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Foreword

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies). The work of preparing International Standards is normally carried out through ISO technical committees. Each member body interested in a subject for which a technical committee has been established has the right to be represented on that committee. International organizations, governmental and non-governmental, in liaison with ISO, also take part in the work. ISO collaborates closely with the International Electrotechnical Commission (IEC) on all matters of electrotechnical standardization.

International Standards are drafted in accordance with the rules given in the ISO/IEC Directives, Part 2.

The main task of technical committees is to prepare International Standards. Draft International Standards adopted by the technical committees are circulated to the member bodies for voting. Publication as an International Standard requires approval by at least 75 % of the member bodies casting a vote.

Attention is drawn to the possibility that some of the elements of this document may be the subject of patent rights. ISO shall not be held responsible for identifying any or all such patent rights.

ISO 21727 was prepared by Technical Committee ISO/TC 36, *Cinematography*.

Introduction

This International Standard should be used in conjunction with the standards that cover the reproduction of motion-picture sound, A-chain and B-chain, including ISO 2969.

A recommended replay level architecture exists for most current cinema sound formats. This matches a specific recorded modulation level with a specific sound-pressure level at the main seating position in a room designed in accordance with BS 5550-7.4.1. The noise and over-modulation points of each sound format are positioned to allow for a wide range of signal components to be recorded and faithfully reproduced at a valid absolute level as part of a motion-picture soundtrack.

Perhaps due to their competitive nature, many motion-picture commercials and trailers make sustained use of the highest recording level possible for the format. Consequently, many exhibitors now find the need to reduce the replay level to a point much lower than the recommendation. This has caused uncertainty as to the validity of the recommended replay level, which in turn creates problems in matching dubbing theatre sound to that expected from the average cinema.

This standard is intended to assist in assessing the subjective loudness of motion-picture sound so that a better match between the sound levels of commercials, trailers and main features is maintained, and so that confidence in the validity of the recommended replay level is re-established.

Cinematography — Method of measurement of perceived loudness of motion-picture audio material

1 Scope

This International Standard specifies a method of measurement of motion-picture sound that allows assessment of the subjective loudness and annoyance of the sound recording when replayed at the recommended replay level in rooms aligned with the characteristics of ISO 2969. The specified method of measurement assesses the entire duration of the sound recording with suitable channel summation, frequency weighting and time integration.

NOTE Typical recording and replay levels are discussed in Annex A.

2 Normative references

The following referenced documents are indispensable for the application of this document. For dated references, only the edition cited applies. For undated references, the latest edition of the referenced document (including any amendments) applies.

ISO 2969:1987, *Cinematography — B-chain electro-acoustic response of motion-picture control rooms and indoor theatres — Specifications and measurements*

3 Terms and definitions

For the purposes of this document, the following terms and definitions apply.

3.1
reference level
modulation level equivalent to 50 % modulation of optical variable-area soundtrack, -20 dB (level relative to digital full-scale) in the digital domain and 185 nW/m in the magnetic domain, measured using an average responding meter and a steady-state tone

NOTE 100 % modulation of a single track of a two-track variable-area soundtrack has a dimensional modulation of 838,2 µm (0,033 in).

3.2
reference pink noise
pink noise, band-limited to 20 Hz to 20 kHz, set at the reference level, using an average responding meter

3.3
pink noise
stochastic signal having a continuous spectrum from at least 20 Hz to 20 kHz with equal energy ± 0,5 dB per one-third octave of frequency and a Gaussian probability distribution of instantaneous amplitude

3.4
recommended replay level
sound-pressure level (C-weighted with slow response) that the sound system should produce in the main seating area of the room with reference pink noise

NOTE For example, a sound system set to a recommended replay level of 85 dB (C-frequency-weighted sound-pressure level relative to 20 µPa) will produce a sound-pressure level of 85 dB (C-weighted) in the main seating area of the room with reference pink noise.

3.5
M-type frequency weighting
filter function as defined in Table 1

NOTE 1 This filter function is based on a filter recommended by the International Telecommunications Union for the assessment of background noise in audio programmes.

NOTE 2 This filter function has also been found to be useful for the purpose of assessing the human response to the loudness and annoyance of motion-picture soundtracks in calibrated rooms.

Table 1 — M-type frequency weighting

Frequency Hz	Gain dB	Tolerance dB
31	– 35,5	± 2,0
63	– 29,5	± 1,4
100	– 25,4	± 1,0
200	– 19,4	± 0,85
400	– 13,4	± 0,7
800	– 7,5	± 0,55
1 000	– 5,6	± 0,5
2 000	0,0	± 0,5
3 150	3,4	± 0,5
4 000	4,9	± 0,5
5 000	6,1	± 0,5
6 300	6,6	± 0,0
7 100	6,4	± 0,2
8 000	5,8	± 0,4
9 000	4,5	± 0,6
10 000	2,5	± 0,8
12 500	– 5,6	± 1,2
14 000	– 10,9	± 1,4
16 000	– 17,3	± 1,65
20 000	– 27,8	± 2,0
31 500	– 48,3	± 2,8

4 Method of measurement

4.1 General

The measurement shall be carried out in the electrical domain in accordance with 4.2, which follows the steps shown in Figure 1.

NOTE An acoustical method of measurement would be impractical and provide results of low accuracy and low repeatability.

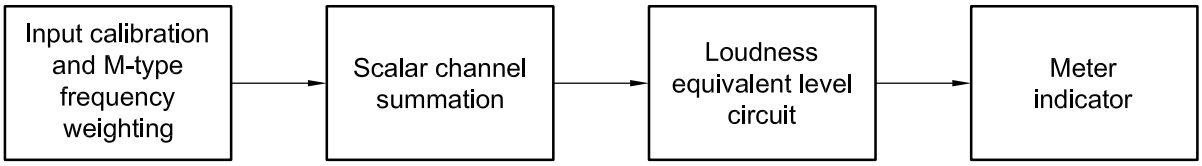

Figure 1 — Method of measurement

4.2 Procedure

4.2.1 Input calibration and M-type frequency weighting

Scale each input channel independently to normalize the reference level of the recording (recorded test tone) to a level which represents that channel's recommended replay level, and then implement M-type frequency weighting.

NOTE 1 Absolute sound-pressure levels can be electrically represented by reference to a known level which represents 20 µPa.

NOTE 2 A typical six-channel calibration is shown in Table 2.

Table 2 — Typical six-channel calibration

Channel	Sound-pressure level[a] dB
Left	85
Centre	85
Right	85
Left surround	82
Right surround	82
Subwoofer	85

[a] C-frequency-weighted sound-pressure level relative to 20 µPa

4.2.2 Scalar channel summation

Rectify and square the scaled M-type weighted signals of each audio channel, and then sum the signals together.

NOTE This procedure ensures that the channel summation is scalar (ignoring phase) rather than vector. It therefore simulates multi-sourced, broad-band, reverberant-field, acoustical summation.

4.2.3 Loudness-equivalent level

Measure the mean of the scalar sum over the duration of the sound recording (typically, first frame of action to last frame of action) and take its square root.