Australian Standard®

GUIDE TO THE USE OF SOUND MEASURING EQUIPMENT

Part 2—PORTABLE EQUIPMENT FOR INTEGRATION OF SOUND SIGNALS

This Australian standard was prepared by Committee AK/2, Techniques for Measurement. It was approved on behalf of the Council of the Standards Association of Australia on 25 October 1983 and published on 2 December 1983.

The following interests are represented on Committee AK/2:

Australian Acoustical Society

CSIRO, Division of Building Research

CSIRO, National Measurement Laboratory

Department of Aviation

Department of Industrial Relations, N.S.W.

Department of Transport

Environment Protection Authority

Metal Trades Industry Association of Australia

National Acoustic Laboratories

Telecom Australia

University of Adelaide

University of Queensland

This Standard was issued in draft form for comment as DR 82012.

Australian Standard®

GUIDE TO THE USE OF SOUND MEASURING EQUIPMENT

Part 2—PORTABLE EQUIPMENT FOR INTEGRATION OF SOUND SIGNALS

First published 1983

PUBLISHED BY STANDARDS AUSTRALIA
(STANDARDS ASSOCIATION OF AUSTRALIA)
1 THE CRESCENT, HOMEBUSH, NSW 2140

ISBN 0 7262 3227 0

PREFACE

This standard was prepared by the Association's Committee on Techniques for Measurement. It is the second part of a publication which is being published in several parts.

The purpose of this standard is to provide guidance in the use of integrating instruments such as integrating (or averaging) sound level meters and sound exposure meters (or noise dosemeters), which are being used extensively for making sound measurements.

This standard is intended for use in conjunction with SAA MP44, Part 1.

CONTENTS

Page

FOREWORD 4

SECTION 1. SCOPE AND GENERAL

1.1 Scope 5
1.2 Application 5
1.3 Referenced Documents 5
1.4 Definitions 5

SECTION 2. INTEGRATING SOUND MEASURING INSTRUMENTS

2.1 Introduction 6
2.2 Comparison with the Sound Level Meter 6
2.3 Features Shared with the Sound Level Meter 6

SECTION 3. THE INTEGRATING SOUND LEVEL METER

3.1 General 9
3.2 Dynamic Range 9
3.3 Overload Indication 9
3.4 Integration Time 10
3.5 Display 10
3.6 Checks on Operation 10
3.7 Uses for the Integrating Sound Lever Meter 10
3.8 Reliability of Measurement 11
3.9 Reporting Results 11

SECTION 4. THE SOUND EXPOSURE/NOISE DOSEMETER

4.1 General 12
4.2 Operation 12
4.3 Overload Indication 12
4.4 Display 12
4.5 Calibration 12
4.6 Checks on Operation 12
4.7 Uses for the Sound Exposure Meter 12
4.8 Reliability of Measurement 13
4.9 Reporting Results 13

APPENDIX A. COMPARISON OF CAPABILITIES OF DIFFERENT SOUND MEASURING EQUIPMENT 14

STANDARDS ASSOCIATION OF AUSTRALIA

Australian Standard
for
GUIDE TO THE USE OF SOUND MEASURING EQUIPMENT

PART 2—PORTABLE EQUIPMENT FOR INTEGRATION OF SOUND SIGNALS

FOREWORD

Over the past two decades or so, there has been an increasing consciousness in the community of the psychological and physiological effects of noise on man. The need for noise control is receiving greater emphasis than ever before with the continued expansion of hearing conservation programs in industry and the appearance of legislation covering many aspects of noise. Hand in hand with this increased recognition of the need for noise control goes the necessity for objective sound measurements to be made according to standardized procedures so that the measured results may be evaluated against predetermined criteria for acceptability.

The aim of this series of documents is to give the user of sound measuring equipment an appreciation of the factors of importance in obtaining valid measurements. It is being published in several parts. Part 1* gives basic information and procedures which enable the reader to make meaningful sound measurements with a portable sound level meter after having acquired some experience.

In Part 2, i.e. this standard, integrating (averaging) and exposure (dose) meters are discussed at about the same level of sophistication as the treatment of sound level meters in Part 1. Basic information on sound measurement given in Part 1 is not repeated in Part 2, but it is equally important in using integrating instruments and this standard must be read in conjunction with Part 1.

Part 3† provides information on more complex equipment for the analysis of sound signals and is intended for use by those readers who have already developed some expertise and wish to undertake more complex measurement tasks.

It is worthwhile to repeat the warning given in the Foreword to Part 1, that compliance with the principles set out in this standard is not sufficient to make the reader an expert in the field of sound measurement. However, if its contents and the information supplied by manufacturers are understood and applied, a fair degree of competence in the making of sound measurements with an integrating meter should result.

---

* Part 1 was published as SAA MP44, Part 1 (see also Clause 1.3).
† In course of preparation.

SECTION 1. SCOPE AND GENERAL

1.1 SCOPE. This standard sets out guidelines on the use of portable integrating sound measuring instruments. It does not deal with the statistical analysis functions of more complex instruments.

It provides guidance on types of integrating (or averaging) sound level meters and sound exposure (or noise dose) meters.

1.2 APPLICATION. This standard when read in conjunction with SAA MP44, Part 1 provides guidance on the use of sound measuring instruments including the microphones, extension cables, windscreens and calibration equipment normally supplied with such instruments, under various physical and environmental conditions, with the intention of ensuring that measurements will be reproducible and comparable.

1.3 REFERENCED DOCUMENTS. The following documents are referred to in this standard:

AS 1259 Sound Level Meters

AS 1633 Glossary of Acoustic Terms

SAA MP44 Guide for the Use of Sound Measuring Equipment
Part 1—Portable Sound Level Meters*.

1.4 DEFINITIONS. For the purpose of this standard, the definitions given in AS 1633, and the following, apply:

1.4.1 Sound pressure level—in decibels, is 10 times the logarithm to base 10 of the square of the ratio of the sound pressure p to a reference pressure p_o. In air the reference pressure is 20 μPa. (Symbol: L_p)

$$L_p = 10 \log_{10}(p/p_o)^2$$

1.4.2 Weighted sound pressure level—in decibels, is 10 times the logarithm to base 10 of the square of the ratio of the frequency-weighted sound pressure to the reference pressure. The frequency weighting used must be indicated. (Symbol: L_{pA}, L_{pC}, etc)

$$L_{pA} = 10 \log_{10}(p_A/p_o)^2$$

1.4.3 Equivalent continuous sound pressure level—in decibels, is 10 times the logarithm to base 10 of ((the integral with respect to time, over an interval T, of the square of the ratio of the instantaneous sound pressure to the reference pressure) divided by the interval). The interval must be indicated. (Symbol: $L_{eq,T}$, etc)

$$L_{eq,T} = 10 \log_{10} \frac{1}{T} \left[\int_o^T (p(t)/po)^2 dt \right]$$

1.4.4 Equivalent continuous weighted sound pressure level—in decibels, is 10 times the logarithm to base 10 of ((the integral with respect to time, over an interval T, of the square of the ratio of the instantaneous frequency-weighted sound pressure to the reference pressure) divided by the interval). The interval and the weighting used must be indicated. (Symbols: $L_{Aeq,T}$, $L_{Ceq,T}$)

$$L_{Aeq,T} = 10 \log_{10} \frac{1}{T} \left[\int_o^T (p_A(t)/p_o)^2 dt \right]$$

NOTE: The equivalent continuous weighted sound pressure level is sometimes referred to as 'the equivalent continuous sound level' or 'the energy equivalent continuous sound level'.

1.4.5 Sound exposure—in an interval of time T, is given by the integral over that time of the instantaneous A-weighted sound pressure squared. The time interval must be indicated (Symbol: E_T).

$$E_T = \int_0^T [p_A(t)]^2 \, dt$$

NOTE: Sound exposure is a dimensional quantity, unlike sound pressure level or noise dose, the unit having the dimensions of pressure squared × time. To conform strictly to the International System of Units, exposure should be expressed in pascal squared seconds ($Pa^2.s$). It is, however, more usual to express it in pascal squared hours ($Pa^2.h$).

1.4.6 Sound exposure level—in decibels, is 10 times the logarithm to base 10 of the ratio of an exposure E_T in pascal squared seconds ($Pa^2.s$) to a reference exposure E_o of $4 \times 10^{-10} Pa^2.s$ The reference exposure is that arising from a sound pressure of 20 μPa acting for 1 s. (Symbol: L_{AE} or L_{AX})

$$L_{AE} = 10 \log_{10}(E_T/E_o)$$

1.4.7 Noise dose—the ratio of a sound exposure in pascal squared hours ($Pa^2.h$) to a reference exposure of 3.2 $Pa^2.h$. The reference exposure is that arising from an A-weighted sound pressure level of 90 dB for 8 h corresponding to a noise dose equal to unity. Noise dose may be expressed in decimal form or as a percentage.

---

* SAA MP44, Part 1 is in course of revision and is to be issued as AS 2659, Part 1.