

# Product Data

## Precision Integrating Sound Level Meter — Type 2236

**USES:**

- Measuring environmental noise
- Measuring occupational noise
- Frequency analysis of sound sources
- Simultaneous RMS and Peak measurements with independent frequency weighting
- Automatic logging of results
- Performs complete statistical analyses
- 40 records of manually stored results
- Back-lit display

**FEATURES:**

- Conforms with IEC 651 (1979) and 804 (1985) Type 1
- Conforms with ANSI S1.4-1983 and Draft S1.43-199X Type 1
- Calculates and displays  $L_N$  values\*
- Automatic-start allows for unattended measurements
- Optional octave filter

\* user-definable for USA, UKe and Japanese models

Precision Integrating Sound Level Meter Type 2236 is a Type 1 instrument, designed to meet stringent standards in environmental- and occupational-noise measurement.

As Type 2236 is designed to fulfil the national standards and directives, all parameters can be obtained from the one measurement. This saves both time and money.

Measurements are displayed on a large (4 lines, 16 characters/line) LCD screen. The SPL (RMS) is continuously monitored on a quasi-analogue display. The digital output allows interfacing with personal computers and printers, for further data processing/presentation and printing.

The linearly-weighted AC output allows for a direct calibrated recording (on Digital Audio Tape, for example), enabling later analysis.

### Description

Precision Integrating Sound Level Meter Type 2236 has been designed specifically for environmental- and occupational-noise measurements.

#### Double-detector

A unique feature of the 2236 is that RMS and Peak detection occurs in parallel. In this way the sound level meter can display both the RMS value and the Peak value of the same signal — particularly useful when analyzing transients or impulses.

#### Intuitive User-interface

The clearly marked front panel, combined with the large LCD screen (with back light) make the sound level meter very easy to learn and use. The display is clear and concise, and an interactive dialog guides you through your measurement, quickly and efficiently. Warnings are also given when you attempt to change a set-up parameter once you have started your measurement.

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#### Statistics

The sound level meter has three user-definable  $L_N$  values (only two fixed ones for the International version). With the USA and UKe models you can also perform Level and Cumulative Distributions on the results, allowing basic statistics on the spot.

#### Real-time Clock

The 2236 sound level meter has a real-time clock for marking results with the date and time of any measurement — particularly useful for storing data for future use or pres-



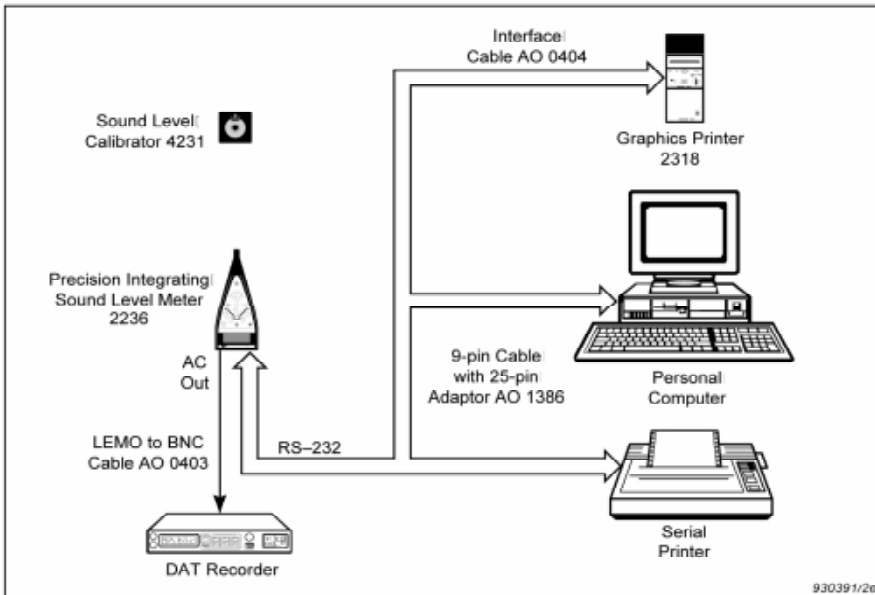


Fig.1 System setup for printing, recording and transferring results from the sound level meter

entation. The clock can be set directly from the front panel of the sound level meter, or over the digital interface.

#### Auto-start

The real-time clock has a timer feature which allows you to set up the sound level meter so that it automatically starts measuring at a predefined point in time (up to one month ahead).

#### Data Storage & Processing

For each individual measurement, the sound level meter logs the time,  $L_{eq}$ , and depending on the version, MaxL and MaxP, or  $L_{10}$  and  $L_{90}$ . This information is stored as a set. You can store up to 21600 sets of results (for example, 6 hrs logging at 1s intervals) in the sound level meter's 128Kbyte non-volatile memory. These results can be transferred in a spreadsheet-compatible format via the built-in serial interface to a PC for additional analysis or graphical presentation.

#### Interfacing to External Devices

The sound level meter communicates to external devices via the interface. By using the 9-pole to LEMO Cable AO 0404, and 9-pole Cable with 25-pole Adaptor AO 1386 you can easily connect the sound level meter to Graphics Printer Type 2318, a PC or a serial printer.

The AC output of the sound level meter can also be connected to a DAT recorder via LEMO to BNC Cable AO 0403.

#### AC & DC Outputs

The AC output from the sound level meter is the unweighted output signal from the preamplifier. This can be recorded on a DAT recorder, and used for further spectral analysis and noise source identification.

The DC output is the analogue equivalent of whatever parameter is currently being measured, except that it does not include the correction for the range and the microphone K-factor.

#### Printing Results

Once you've finished measuring you can print your results, either on the lightweight Graphics Printer Type 2318, Serial Printer Types WQ 1138, EQ 4001 or EQ 4002, or any standard serial printer.

#### Simplified Calibration

The sound level meter employs a very user-friendly calibration technique. Once you have fitted the calibrator (Sound Level Calibrator Type 4231, Multifunction Acoustic Calibrator Type 4226 or a similar calibrator), the sound level meter calculates the correction and prompts you either to continue with the old calibration, or do an automatic re-calibration.

#### Optional Features

##### Internal Filters

Type 2236 is also available with nine built-in  $1/1$ -octave filters at  $1/1$ -octave

intervals. These band-pass filters have centre frequencies of 31.5 Hz, 63 Hz, 125 Hz, 250 Hz, 500 Hz, 1 kHz, 2 kHz, 4 kHz and 8 kHz.

#### dB2XL Software

The dB2XL software allows you to transfer the measurement results from the sound level meter directly into a Microsoft<sup>®</sup> Excel spreadsheet, and to produce basic graphs.

#### Reporter<sup>™</sup> Software

This, more comprehensive software, allows you to generate reports from the measurement results obtained from the sound level meter and display them.

#### Accredited Calibration

The sound level meter can also be sold with an accredited calibration that conforms to IEC 651 and IEC 804.

#### Example Printout

Fig. 2 shows a printout from Graphics Printer Type 2318 for a Level Distribution measurement.

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                Bruel & Kjaer
                SLM Type 2236

SETTINGS:
-----
F                    50-130 dB
RMS: A                Peak:C

LOGGED RESULTS:
-----
12 Apr 1993          15:11:19

          Leq  MaxL  MaxP
hhmmss  [dB]  [dB]  [dB]
151119  73.8  82.0  95.7
151120  78.6  89.1  99.0
151124P 76.1  86.8  96.5
151125  78.4  92.3 102.6
151126O 75.1  91.2 103.7
151128& 78.1  93.5 103.9
151129  77.7  93.0 103.3
151130  77.7  93.0 103.3
151131  72.8  88.9  98.8
151132  74.3  91.5 101.6
151133  63.7  79.9  88.8
151134  69.3  83.8  93.1
151135  60.6  77.7  84.4
151136  70.2  88.4  98.2
151137  68.0  87.1  96.8
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93117/1/e

Fig.2 Printer (24 character/line) output format with short heading

# Specifications 2236

## STANDARDS:

Conforms with IEC 651 (1979) and 804 (1985) Type 1, and ANSI S1.4 – 1983 and Draft S1.43, 6th September, 1992 Type 1  
 1/1-octave filter set conforms with IEC 225 – 1966 and ANSI S1.11–86, order 3, Type 1–D (Types 2236 C and 2236 D only)

## MEASURING RANGES:

Range (dB)	Max. Peak level	Upper limit (RMS) for signals with crest factor = 10 (20dB)
10 <sup>-</sup> – 90	93	73
20 <sup>+</sup> – 100	103	83
30 – 110	113	93
40 – 120	123	103
50 – 130	133	113
60 – 140	143	123

\* Only available with Types 2236 C and 2236 D when filter selected.  
 Level non-linearity caused by noise floor is < 0.4 dB at 30 dB(A) (re IEC 651) and < 1 dB at 26 dB(A)  
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## NOISE FLOOR:

**Typically:** 18 dB(A)  
**Maximum:** 20 dB(A) RMS  
 Includes preamplifier's electrical noise and microphone's thermal noise

## DETECTORS:

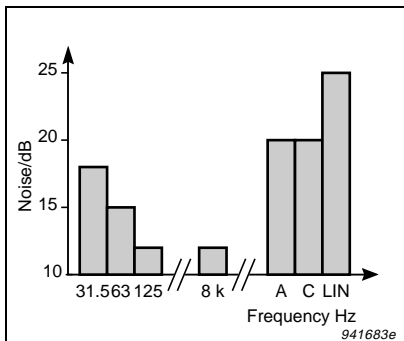
Simultaneous RMS and Peak with independent frequency weightings  
**Linearity Range:** 80 dB  
**Pulse Range:** 83 dB  
**Non-linear Distortion:** Too small to affect accuracy  
**Peak Detector Rise Time:** < 50 μs

## FREQUENCY WEIGHTING:

Selected independently for RMS and Peak  
**RMS:**  
 A, C according to IEC 651 Type 1  
 L: flat from 10 Hz to 20 kHz (±2 dB) with Type 1 tolerances  
**Peak:**  
 C according to IEC 651 Type 1  
 L: flat from 10 Hz to 20 kHz (±2 dB) with Type 1 tolerances

## FILTER (only available with Types 2236 C and 2236 D):

**Band-pass Filters:** Nine 1/1-octave filters at 1/1-octave intervals (base 10)  
**Centre Frequencies:** 31.5, 63, 125, 250, 500 Hz, 1, 2, 4, 8 kHz  
**Maximum Noise Floor in Each Frequency Band:**  
 See diagram for details



## TIME WEIGHTING:

Int.	USA	UKi	UKe	Jap.
S, F, I	S, F, I	S, F	S, F, I	S, F, I

according to IEC 651 Type 1

## DISPLAY:

4 line LCD showing:  
 • Measuring range and quasi-analogue bar showing input signal  
 • Battery low, pause and overload with hold indicators  
 • Time weighting and elapsed measurement time  
 • Frequency weighting (Peak or RMS) or filter centre frequency (only available with Types 2236 C and 2236 D), selected parameter with level

## Optional back-light

The quasi-analogue bar is updated 15 times per second  
 Displayed parameter level updated once per second

## PARAMETERS:

**Common (and UKi only):** MaxL, MinL, MaxP, Peak, SPL, L<sub>eq</sub>, SEL, L<sub>EP,d</sub> and Overload in % of measurement time  
**Specific:**

	Int.	USA	UKe	Jap.
L <sub>Im</sub>	✓	✓	✓	✓
Inst.				✓
IEL	✓	✓	✓	
LAE				✓
LCE				✓
LLE				✓
L <sub>AV,4</sub>		✓		
L <sub>AV,5</sub>		✓		✓
Variable L <sub>N</sub>		✓	✓	✓
Defaults (fixed for Int. Version)	L <sub>95</sub> L <sub>5</sub>	L <sub>90</sub> L <sub>50</sub> L <sub>10</sub>	L <sub>90</sub> L <sub>50</sub> L <sub>1</sub>	L <sub>95</sub> L <sub>50</sub> L <sub>5</sub>

## Resolution:

**L<sub>N</sub> Values:** 0.5 dB  
**Other Parameters:** 0.1 dB

## EXCHANGE RATE:

Int.	USA	UKi	UKe	Jap.
3	3, 4, 5	3	3	3, 5

## RESET:

Resets Buffer (including elapsed time) to zero. Warning prior to reset if elapsed time > 1 min. Reset when changing frequency or time weighting  
 Resets all results in Log, Memory and Buffer if held down together with <Data>  
 Optional reset when changing level of measurement range (L<sub>N</sub>s not available if range change is without reset)

## MICROPHONE:

Type 4188 prepolarized free-field 1/2" condenser microphone  
**Sensitivity:** -30 dB re 1 V/Pa ±2 dB  
**Frequency Range:** 8 Hz to 12.5 kHz ±2 dB  
**Capacitance:** 12 pF

## MEMORY:

40 Records of Overall Results  
**RESULT LOGGING:**

Int.	USA	UKi	UKe	Jap.
L <sub>eq</sub>	L <sub>eq</sub>	L <sub>eq</sub>	L <sub>eq</sub>	L <sub>eq</sub>
MaxL	L <sub>10</sub>	MaxL	L <sub>10</sub>	L <sub>5</sub>
MaxP	L <sub>90</sub>	MaxP	L <sub>90</sub>	L <sub>95</sub>

Log Rate	Log Cap.	Int.	USA	UKi	UKe	Jap.
0.1 s <sup>-</sup>	36 m		✓		✓	✓
1 s	6 h	✓	✓	✓	✓	✓
10 s	2 1/2 d		✓	✓	✓	✓
30 s	7 1/2 d			✓	✓	✓
1 m	15 d	✓	✓	✓	✓	✓
5 m	75 d			✓	✓	✓
10 m	150 d		✓	✓	✓	✓
15 m	225 d			✓	✓	✓
30 m	450 d		✓	✓	✓	✓
60 m	900 d		✓	✓	✓	✓

\* only L<sub>eq</sub> logged at this rate

## Logged To: log or interface

**Memory Capacity:** 128 Kbytes (Types 2236 A and 2236 C). Equivalent to 21600 sets of results (for example, 6 hrs of 1 s logging).  
 512 Kbytes (Types 2236 B and 2236 D). Equivalent to 86400 sets of results (for example, 24 hrs of 1 s logging)

## SERIAL INTERFACE:

Compatible with EIA-574  
 Compatible with EIA-232-E with 25-pole adaptor  
**Baud Rate:** 1200 – 19200 (1200 – 9600 for Japanese version)  
**Data Bits:** 8  
**Stop Bit:** 1  
**Parity:** None  
**Handshake:** Hardware, XON/XOFF or None

Result Output Formats	Int.	USA	UKi	UKe	Jap.
Overall	✓	✓	✓	✓	✓
Logged (Printer)	✓	✓	✓	✓	✓
Logged (2318)	✓	✓	✓	✓	✓
Logged (Spreadsheet)	✓	✓	✓	✓	✓
Level Distribution		✓		✓	✓
Cumulative Distribution		✓		✓	✓
Distribution Resolution (dB)		1 or 5		1 or 5	0.5, 1, 2, 5, 10

**Heading:** Long or short (only short for USA model)

## DC OUTPUT:

Short-circuit protected coaxial LEMO socket (series 00)

**Output:** 50mV/dB equivalent to 0 – 4.15V  
**Output Resistance:** 100Ω  
**Output Parameter:** Same as the Displayed Parameter (Detector Output on Japanese model)  
**Updated:** every second (160 times/second for Japanese model)

**AC OUTPUT:**

Short-circuit protected coaxial LEMO socket (series 00)

**Max. Output:** 0.5V RMS corresponding to the top of the selected measurement range ±2dB depending on the microphone's sensitivity

**Output Resistance:** 100Ω

**Output:** Output signal from preamplifier (L frequency weighting)

**CLOCK:**

Real-time (calendar) and measurement duration  
 Factory set to CET (GMT+1)

**WARM-UP TIME:**

<5s

**SETTLING TIME:**

**At Range Change without Reset:** <4ms

**CALIBRATION CONDITIONS:**

**Reference Frequency:** 1000Hz

**Reference SPL:** 94dB

**Reference Range:** 50–130dB (set automatically during calibration sequence)

**Reference Direction of Incidence:** Frontal

**Calibration Correction with Extension Cable:** 0dB

**ENVIRONMENTAL EFFECTS:**

**Storage Temperature:** –25 to +70°C (–13 to +158°F)

**Operating Temperature:** –10 to +50°C (14 to 122°F)

**Effect of Temperature:** <0.5dB (–10 to +50°C)

**Effect of Humidity:** <0.5dB for 30%<RH<90% (at 40°C, 1kHz)

**VIBRATION SENSITIVITY:**

<80dB with L-weighting at 1m/s<sup>2</sup>

**EFFECT OF MAGNETIC FIELD:**

80A/m (1Ørsted) at 50Hz gives <34dB(L)

**ELECTROMAGNETIC COMPATIBILITY:**

**Designed to Fulfil:**

**Emission:**

EN50081–1: residential, commercial and light industry (including EN55022 class B)

EN50081–2: industrial environment

FCC class B part 15J

CISPR22 class B

**Immunity:**

EN50082–1: residential, commercial and light industry

prEN50082–2: industrial environment

**BATTERIES:**

Four 1.5V LR6/AA size alkaline cells

**Lifetime (at room temperature):**

Typically > 12hrs for Types 2236A and 2236B

Typically > 10hrs for Types 2236C and 2236D

**Internal back-up battery:**

**Charging time:** ~10hours (1st time)

Keeps clock and memories operating for at least 6months (typically) if fully charged

**EXTERNAL POWER SUPPLY:**

Must fulfil the following specifications

**Voltage:** regulated or smoothed 7–15V DC

**Voltage Ripple:** <100mV peak to peak

**Maximum Current:** 400mA

**Average Current:** ~100mA at 7V

**Socket:**

**Pin:** Positive

**Casing:** Signal Ground

**Pin Diameter:** 2.0mm

**External Diameter:** 5.5mm

**PHYSICAL CHARACTERISTICS:**

**Size:** 257×97×41mm

**Weight:** 460g (including batteries)

## Ordering Information

- 2236 A – xxx Precision Integrating Sound Level Meter with 128 Kbyte memory
- 2236 B – xxx Precision Integrating Sound Level Meter with 512 Kbyte memory
- 2236 C – xxx Precision Integrating Sound Level Meter with 128 Kbyte memory and 1/1-octave filter set
- 2236 D – xxx Precision Integrating Sound Level Meter with 512 Kbyte memory and 1/1-octave filter set

The –xxx extension refers to the particular English-language version.

Version	–xxx Extension
International (Int.)	–002
United States (US)	–007
United Kingdom Industrial-noise (UKi)	–008
United Kingdom Environmental- and Industrial-noise (UKe)	–009
Japanese (Jap.)	–010

**Includes the following accessories:**

4 × QB0013 1.5V LR6/AA alkaline cells  
 Type 4188 Prepolarized Free-field 1/2" Microphone

KE 0323 Shoulder Bag  
 UA 1236 Protective Cover

### Optional Accessories

**For Measuring:**

- Type 4231** Sound Level Calibrator
- Type 4226** Multifunction Acoustic Calibrator
- UA 1251** Tripod
- UA 0801** Tripod
- UA 1254** Microphone Holder (for tripod)
- UA 0459** Windscreen (Ø 65 mm)
- AO 0408** Microphone Extension Cable (3m)
- AO 0409** Microphone Extension Cable (10m)
- ZT 0326** Octave Filter Set Upgrade
- Type 4189** Prepolarized Free-field 1/2" Microphone

**For Transferring Results to a PC:**

**AO 1386** 9-pole Cable with 25-pole Adaptor

**For Recording on a DAT Recorder, Transferring Signals to an Analyzer or Using with Headphones:**

**AO 0403** LEMO to BNC Cable

**For Printing:**

- Type 2318** Graphics Printer
- WQ 1138** Serial Printer (Euro version)
- EQ 4001** Serial Printer (US version)
- EQ 4002** Serial Printer (UK version)
- AO 0404** 9-pole to LEMO Cable (for 2318)
- AO 1386** 9-pole Cable with 25-pole Adaptor (for serial printer)

**Upgrades:**

**ZT 0326** Octave Filter Set (for A and B models)

**Carrying Case:**

**KE 0325** Carrying Case with insert for sound level meter, Sound Level Calibrator Type 4231, Serial Printer WQ 1138 and Tripod UA 1251

**Services available with delivery:**

**EK 0102** Accredited Calibration re IEC 651 and IEC 804

Brüel&Kjær reserves the right to change specifications and accessories without notice



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