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Product Data

Precision Integrating Sound Level Meter — Type 2236

USES:

❍ Measuring environmental noise

❍ Measuring occupational noise

❍ Frequency analysis of sound sources

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[*]

❍ 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

❍ 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 arrows and symbols on the front panel, combined with the large LCD screen (with back light) make the sound level meter very easy to learn and use. The dis-

play 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.

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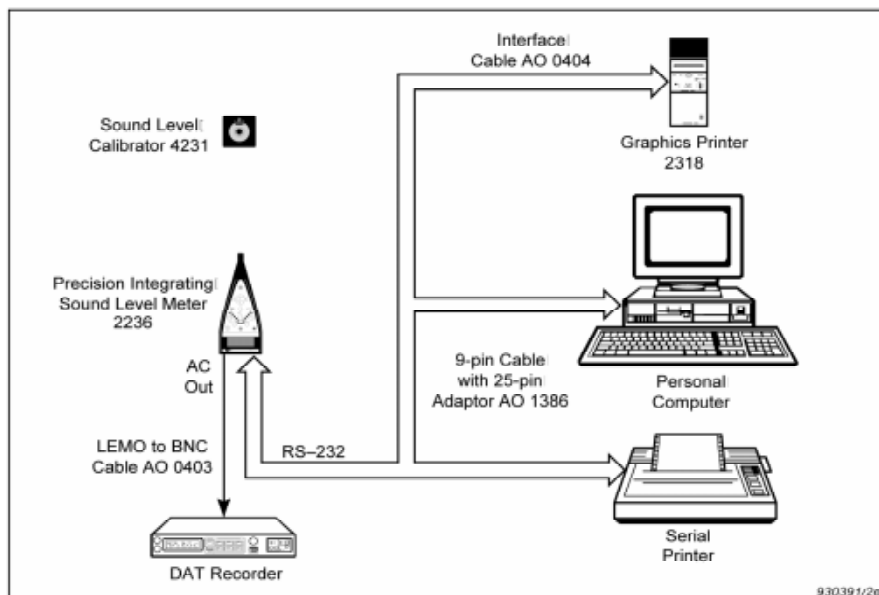
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Fig. 1 *System setup for printing, recording and transferring results from the sound level meter*

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 1 s 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® Excel spreadsheet, and to produce basic graphs.

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

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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 (20 dB)
10* – 90	93	73
20† – 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)

† 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)

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
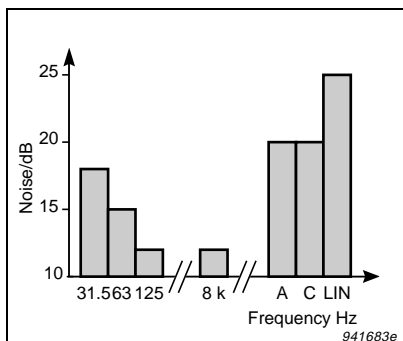L: flat from 10 Hz to 20 kHz (±2 dB) with Type 1 tolerances

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

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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_{eq}, SEL, $L_{EP,d}$ and Overload in % of measurement time
Specific:

	Int.	USA	UKe	Jap.
L_{Im}	✓	✓	✓	✓
Inst.				✓
IEL	✓	✓	✓	
LAE				✓
LCE				✓
LLE				✓
$L_{AV,4}$		✓		
$L_{AV,5}$		✓		✓
Variable L_N		✓	✓	✓
Defaults (fixed for **Int.** Version)	L_{95} L_5	L_{90} L_{50} L_{10}	L_{90} L_{50} L_1	L_{95} L_{50} L_5

Resolution:
L_N 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_Ns 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_{eq}	L_{eq}	L_{eq}	L_{eq}	L_{eq}
MaxL	L_{10}	MaxL	L_{10}	L_5
MaxP	L_{90}	MaxP	L_{90}	L_{95}

Log Rate	Log Cap.	Int.	USA	UKi	UKe	Jap.
0.1 s*	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_{eq} 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: Hardwire, XON/XOFF or None

Result Output Formats	Int.	USA	UKi	UKe	Jap.
Overall	✓	✓	✓	✓	✓
Logged (Printer)	✓	✓	✓	✓	✓
Logged (2318)	✓	✓	✓	✓	✓
Logged (Spreadsheet)	✓	✓	✓	✓	✓
Level Distribution		✓		✓	✓
Cumulative Disribution		✓		✓	✓
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)

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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 $1m/s^{-2}$

EFFECT OF MAGNETIC FIELD:
80A/m (1Ørsted) at 50Hz gives <34dB (L)

ELECTROMAGNETIC COMPATIBILTY:
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 2236 A and 2236 B
Typically >10hrs for Types 2236 C and 2236 D
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 7 V
Socket:
  Pin: Positive
  Casing: Signal Ground
  Pin Diameter: 2.0mm
  External Diameter: 5.5mm

PHYSICAL CHARACTERISTICS:
Size: 257×97×41 mm
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 × QB 0013	1.5 V 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 (∅ 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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