# Personal Noise Exposure Meter

# DB22-600E


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6.7 Maximum Allowable Sound Pressure Level on Microphone
135 dB.

6.8 Maximum Peak Input Voltage of Electrical Input Device
3 Vp-p (3 volts peak-to-peak).

6.9 Operating Voltage Range When Sound Level Meter Meets Technical Requirements
4.5 V～6.0 V.



1. Overview
The DB22-600E Personal Sound Exposure Meter is an intelligent noise measurement instrument capable of measuring A-weighted sound pressure level, equivalent continuous sound level (Leq), sound exposure level (LAE), and noise exposure amount (E). It uses advanced digital detection technology and is controlled by a powerful processor, offering features such as automatic range conversion, high reliability, stability, and a wide dynamic range. The meter meets the requirements for Class 2 sound level meters and personal sound exposure meters as specified in GB/T 3785 and GB/T 15952, making it suitable for monitoring environmental noise, evaluating industrial hygiene noise, and analyzing industrial noise from various machines, vehicles, ships, and electrical appliances.

2. Main Technical Performance
2.1 Measurement Range:
- A-weighted sound level: 40 dB－130 dB
- Noise exposure: 0.1－99.9 ($Pa^2 \cdot h$)

2.2 Frequency Range: 20 Hz-8 kHz

2.3 Frequency Weighting: A weighting

2.4 Time Weighting: F (Fast), S (Slow)

2.5 Measurement Time: Manual control, 10 s, 1 min, 5 min, 10 min, 15 min, 30 min, 1 h, 4 h, 8 h, 24 h

2.6 Automatic Measurement Display: Automatic measurement of LA, Leq, Lmax, LAE, E, Tm (measurement time) with 4-digit LCD digital display.

2.7 Microphone: Φ12.7 mm pre-polarized test condenser microphone, nominal sensitivity -32 dB/Pa, frequency range 20 Hz-12.5 kHz.

2.8 Calibration: Calibrated with a Class 2 sound level calibrator (1000 Hz, 94 dB).

2.9 Power Supply: 4*1.5v AAA batteries, continuous operation for over 24 hours.

2.10 Dimensions: 140×77×32 mm

2.11 Mass: 200 g

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2.12 Operating Conditions:
- Temperature: 0℃–50℃
- Relative humidity: < 90%
- Air pressure: 65 kPa–108 kPa

3. Structural Principle
The appearance of the sound level meter is shown in Figure 1.

3.1 Microphone: Converts sound signals into electrical signals and connects to the preamplifier.

3.2 Preamplifier: Built-in type, serving as an impedance transformer.

3.3 LCD: Liquid Crystal Display, which can show various measurement results.

3.6 Panel Buttons
3.6.1 [Fast/Slow] Button: Select between fast (F) and slow (S) time weighting.
3.6.2 [Ts/DEL] Button: Set measurement time and delete data.
3.6.3 [MODE] Button: Read Leq, Lmax, LAE, E, Tm data and perform manual settings.
3.6.4 [RUN/PAUSE] Button: Start automatic measurement or pause manual measurement.
3.6.5 [POWER] Button: Power switch.
3.6.6 [Lmax] Button: Maximum sound level measurement.




5. Sound Calibration
The sound level meter is calibrated and verified before leaving the factory, and regular calibration is generally unnecessary. However, calibration is required if the meter remains unused for an extended period, the microphone is replaced, or maintenance is performed.

Calibration typically refers to sound calibration, which should be conducted using a Class 2 sound calibrator. Follow these steps:
1. Attach the sound calibrator over the microphone.
2. Power on the sound level meter and set it to F (Fast) mode for LA instantaneous value measurement.
3. After approximately 5 seconds, press the button of the sound calibrator. The meter should display 93.8 dB.
4. If the reading deviates, remove the battery cover and adjust the calibration potentiometer with a watchmaker's screwdriver.

Note: Due to the meter's exclusive A-weighted frequency response, do not use sound calibrators with frequencies other than the specified one for calibration.

6. Information Specified for Metrological Purposes
6.1 Reference sound pressure level: 94 dB.
6.2 Reference incident direction: Axial direction of the microphone.
6.3 Microphone reference point: Center of the microphone diaphragm.
6.4 Correction data from sound pressure response to free-field response (reference incident direction).

| Frequency (Hz) | 1k | 1. 25k | 1. 6k | 2k | 2. 5k | 3. 15k |
|---|---|---|---|---|---|---|
| Correction value dB | 0. 2 | 0. 3 | 0. 4 | 0. 5 | 0. 6 | 0. 8 |

| Frequency (Hz) | 4k | 5k | 6. 3k | 8k | 10k | 12. 5k |
|---|---|---|---|---|---|---|
| Correction value dB | 1. 0 | 1. 55 | 2. 1 | 3. 2 | 4. 5 | 6. 2 |

6.5 Electrical Input Device
An equivalent resistive impedance can replace the microphone for electrical signal testing. The equivalent resistive impedance has a capacitance of 20 pF and an insulation resistance greater than 1 GΩ. During use, screw the shielded cylinder with the equivalent resistive impedance onto the preamplifier.

6.6 Maximum Intrinsic Noise
When the sound level meter is placed in a low sound level sound field and the above-mentioned adapter replaces the microphone and is short-circuited, the maximum intrinsic noise shall not exceed 34 dB.

Sound exposure ( E ) is the time integral of the sound pressure squared over a specified time interval or process, given by the following equation:

$$E = \int_{t1}^{t2} P_A^2(t)\,dt$$

eg: $P_A^2(t)$ --within the integration time from start time $t_1$ to end time $t_2$, it is the square of the A-weighted instantaneous sound pressure.

If the A-weighted sound pressure is in pascals (Pa) and the operating time is in hours, the unit of sound exposure is pascal squared hour ($Pa^2 \cdot h$).

The relationship between E and Leq is as follows:

$$L_{AE} = 10\lg \frac{E}{2TP_0^2} \quad (\text{dB})$$

eg: T is the integration measurement time for Leq.

4.7 Measurement of Elapsed Time (Tm)
The measurement method is consistent with the previous steps. Press the [MODE] button to activate "Tm" on the right side of the display—the shown "XX.XX" value represents the elapsed measurement time in minutes · seconds or hours · minutes (for durations over 1 hour).

4.8 Overload and Indication
During measurement, if the sound pressure level is too high and exceeds the linear operating range of the sound level meter, the "Over" overload symbol will appear on the LCD.
- For Lp measurement: The "Over" symbol disappears when the overload condition is resolved.
- For Leq measurement: The "Over" symbol remains throughout the measurement until the current measurement is reset or a new measurement is started, at which point it disappears automatically.

4.9 Wind Screen Usage
Use the wind screen in windy environments to reduce wind noise, which can attenuate wind-induced noise by approximately 10 dB to 15 dB.

4.10 Battery Check and Replacement
The sound level meter automatically detects low battery status. When battery power is insufficient, "LOBAT" will appear in the upper-left corner of the LCD as a reminder to replace the batteries.



3.7 Potentiometer
Adjusts sensitivity during sound calibration.

3.8 Battery Compartment
Accommodates 4*1.5v AAA batteries.

4. Usage Method
4.1 Pre-use Inspection
4.1.1 Verify that the measuring microphone is securely installed.
4.1.2 Check if the batteries are properly placed.
4.1.3 Perform sound calibration on the sound level meter when necessary.
4.1.4 The sound level meter should be periodically sent to the metrology authority for verification to ensure accuracy.
4.1.5 Note: The measuring microphone is a precision component. Do not remove the protective cover during use, and avoid dropping it to prevent damage.

4.2 Measurement of Instantaneous Sound Level LA
- Press the [POWER] button to turn on the device. The LCD will display "XX.X", which indicates the A-weighted sound pressure level. The meter is ready for use after 5 seconds.
- The device defaults to F (Fast) time weighting mode upon startup, with the LA value refreshing every second.
- If the measured noise fluctuates significantly, causing unstable readings, press the [FAST/SLOW] button to switch to S (Slow) time weighting mode. The slow mode extends the averaging time to reduce fluctuations in the displayed value.

4.3 Measurement of Equivalent Continuous Sound Level (Leq)
The equivalent continuous sound level (Leq), also known as the time-averaged sound level, is defined as 20 times the base-10 logarithm of the ratio of the root-mean-square sound pressure to the reference sound pressure over a specified time interval. The sound pressure is obtained using standard frequency weighting, and the unit of Leq is decibel (dB).

$$Leq = 20\lg \left\{ \frac{\left[ \left( \frac{1}{T} \int_{t1}^{t2} P_A^2(t)\,dt \right) \right]^{\frac{1}{2}}}{P_0} \right\}$$

eg:

$$Leq = 10\lg\left[\frac{1}{T}\int_0^T \frac{p_A^2(t)}{P_0^2}dt\right]$$

$$= 10\lg\left(\frac{1}{T}\int_0^T 10^{0.1 L_A}dt\right)$$

$P_A^2(t)$

In the formula: is the instantaneous A-weighted sound pressure,, $P0$is the reference sound pressure, $P0$=20μPa,

T is the integration time, $T=t_2-t_1$; LAis the instantaneous A-weighted sound pressure level.

4.3.1 Manual Time Measurement

Press the [Ts/DEL] button. The LCD will display "——.—", indicating manual time measurement mode.

Press the [MODE] button twice to activate "Leq" on the left side of the LCD. The display will show "0.0" since measurement has not started. If the value is not "0.0", it represents the previous measurement result, which does not affect the current measurement.

Press the [RUN/PAUSE] button. The "RUN" symbol will flash at the top of the display, indicating the start of measurement. The displayed "XX.X" value is the Leq value for the elapsed time up to the current reading.

When the specified time (e.g., 1 minute) is reached, press [RUN/PAUSE] again. The "RUN" symbol stops flashing, pausing the measurement. The displayed value is the Leq for the measured period (e.g., 1 minute).

To continue measurement, press [RUN/PAUSE] again—the sampling symbol will resume flashing. Press [RUN/PAUSE] again to pause, and the displayed value will be the cumulative Leq for both measurement periods.

To terminate or reset the measurement, press [Ts/DEL]. The "RUN" symbol disappears, and the current result is cleared.

Note: Time weighting (F/S) only affects the time-weighted sound level Lp, not the integrated Leq measurement.

4.3.2 Timed Automatic Measurement

Preset the measurement time by pressing [Ts/DEL]:

Press [Ts/DEL] to cycle through display options: 0:10 (10s), 1:00 (1min), 5:00 (5min), 10:00 (10min), 15:00 (15min), 0.30 (30min), 1.00 (1h), 4.00 (4h), 8.00 (8h), 24 (24h), then return to "——.—" (manual mode).



Stop at the desired time to select it (e.g., 1:00 for 1 minute).

Press [MODE] to activate "Leq" on the left side of the LCD.

Press [RUN/PAUSE] to start Leq measurement. The "RUN" symbol will appear, and the display shows the Leq value for the elapsed time.

When the preset time (e.g., 1 minute) is reached, the "RUN" symbol disappears, and the displayed "XX.X" value is the Leq for the preset period.

Press [RUN/PAUSE] again to start a new Leq measurement with the same preset time.

4.4 Measurement of Maximum Sound Level (Lmax)

The measurement method is the same as that for Leq. While measuring Leq, Lmax is also being recorded. To view the Lmax value, press the [MODE] button to activate "Lmax" on the display—the shown "XX.X" will be the maximum sound level.

4.5 Measurement of Sound Exposure Level (LAE)

The measurement method is consistent with the previous procedures. During Leq measurement, LAE is simultaneously recorded. Press the [MODE] button to activate "LAE" on the left side of the display—the displayed "XX.X" value represents the sound exposure level (in dB).

LAE (Sound Exposure Level) is the equivalent sound level over 1 second, used to evaluate single noise events such as an aircraft take off/landing, a vehicle passing by, or a boiler overpressure venting.

$$L_{AE} = 10\lg\left[\frac{1}{T_0}\int_{t1}^{t2}\frac{P_A^2(t)}{P_0^2}dt\right]$$

eg: $(t_2-t_1)$is a sufficiently long time interval that significantly contributes to sound energy for the noise event, and $T_0$=1s is the reference time.

The relationship between LAE and Leq is:

$$Leq = L_{AE} + 10\lg\frac{1}{T}$$

eg: ( T ) is the integration measurement time (s) for Leq.

4.6 Measurement of Noise Exposure (E)

The measurement method is the same as before. While measuring Leq, noise exposure ( E ) is simultaneously recorded. To view the ( E ) value, press the [MODE] button to activate "E" on the right side of the display—the shown "XX.X" will be the noise exposure value ($Pa^2 \cdot h$).