3M | Littmann®
Stethoscopes

Competitive Assessment of Electronic Stethoscope

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Maya Harrison
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3M™ Littmann® Stethoscopes

Dear Maya Harrison,

Thank you for choosing Pollex Consulting to conduct a competitive assessment between the 3M™ Littmann® Electronic Stethoscope Model 3200 and competitors' stethoscopes.

In this report you will find a comparison between the Littmann 3200 model and the Eko Core Digital Stethoscope and Thinklabs One Digital Stethoscope, as well as the top ten ergonomic features of the Littmann 3200 and some opportunities for improvement.

Please do not hesitate to reach out to me with any questions or comments. I look forward to working with you.

Sincerely,

Lexie Kirsch
Human Factors Engineering Consultant
Pollex Consulting

COMPETITIVE ASSESSMENT

The human factors research team at Pollex Consulting assessed the 3M™ Littmann® Electronic Stethoscope Model 3200 against top competitor models—the Eko Core Digital Stethoscope and Thinklabs One Digital Stethoscope—with regard to acoustics, design, and performance. The main findings are summarized in the table below.

Model	Littmann 3200 	Eko Core 	Thinklabs One 
Audio output	In-ear attached earpieces	In-ear attached earpieces; also compatible with many acoustic stethoscopes	Standard 3.5mm jack connects device to headphones of choice
Sound amplification	24X	40X	100X
Ambient noise reduction	Eliminates approximately 85% of ambient noise	Noise filtering	Precision filtering
Visual display	LCD screen interface with screen-guided commands	Mobile app	LED indicators
Performance	Includes software for heart and lung sound visualization; transmits via Bluetooth	Includes mobile app for sound visualization; transmits via Bluetooth	Connects to mobile devices
Battery	Single AA battery; on-screen indicator	Rechargeable; 9-hour life (~21 days of use per charge)	Rechargeable; on-screen indicator; 1-2 charges per week
Differentiating quality	Allows on-board recording (12 30-second recordings with 10-second commentary)	Toggles between analog and digital use; works with hearing aids	Customizable through ability to set two filters as “favorites” for quick selection

COMPETITIVE ASSESSMENT

We focused the assessment on three measures of user interaction quality—acoustics, design, and performance—because these variables are most important to stethoscope users.

Acoustics refer to how sound is transmitted, which is especially important for auscultation because the sounds the stethoscope transmits play a role in the subsequent medical diagnosis. Specifically, a stethoscope must have good *amplification* and *ambient noise reduction*, because the user must be able to hear the sounds from the heart, lungs, or other organs over the noise of the environment, which may range from the white noise of a fan to the whirring propellers of a helicopter. While the Littmann 3200 stethoscope has the lowest range of amplification compared to its top competitors, it has the most impressive data regarding ambient noise reduction, which may eliminate the need for higher amplification.

Design is important for ease of use of the stethoscope. Stethoscopes with intuitive designs allow users to achieve their goals efficiently and effectively. In this regard, the Littmann 3200 stethoscope is very impressive because it features an LCD screen interface that concisely and immediately provides important information and feedback directly to the user. In contrast the Eko Core functions as a regular stethoscope until it is connected to a mobile application.

Finally, **performance** of the stethoscope is assessed as it relates to handling the data that is measured. The ability to save and visualize sound files is useful for sharing and analyzing data, as well as adding it to patients' medical records for future reference. Both the Littmann 3200 and Eko Core include software for visualizing heart and lung sounds, and both devices transmit data via Bluetooth; however, the Littmann 3200 has the additional feature of on-board recording and playback of sounds.

TOP 10 ERGONOMIC FEATURES

Human factors experts at Pollex believe the top ten ergonomic features of the Littmann 3200 stethoscope are the following:

1. The headset is adjustable for comfort.
   - The model comes with two sizes of soft-sealing ear tips so the user can choose the better fit, and the tension in the headset can be reduced or increased.

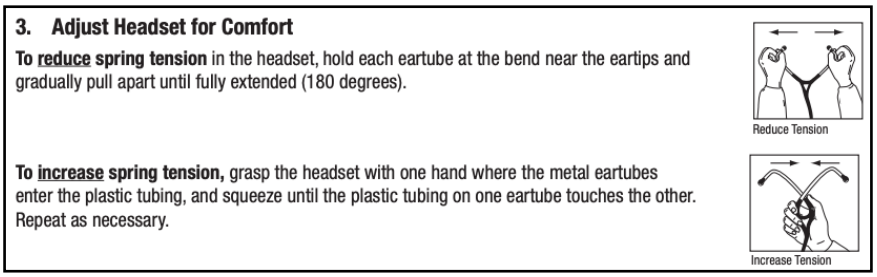


Image of the section of the user manual for manipulating headset tension.

2. The power button is clearly indicated and effective.
   - The size of the button is large enough to be depressed easily.
   - The device requires the user to depress and *hold* the power button to turn off the device, which prevents the user from turning off the device accidentally.

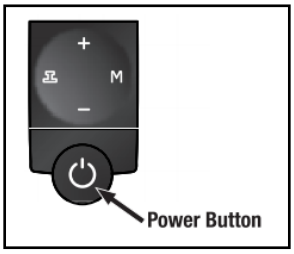


Image of the power button of the device.

3. The diaphragm of the device is appropriate for use on both infants and adults, so the user does not have to exchange the part or use a separate instrument to auscultate patients of varying ages.
4. The device has only five controls, which minimizes information overload.
   - The (+) and (-) buttons serve not only to change amplification level but also to scroll through menu items. This dual function is intuitive and reduces the number of buttons necessary to use the device.
   - The Main menu of the device uses progressive disclosure to minimize the number of options displayed on the LCD screen at a time, thus minimizing the time the user spends scrolling through items to reach their destination.

TOP 10 ERGONOMIC FEATURES

5. The interface of the LCD display is clear and effective.
   - The display provides feedback about whether the stethoscope is on or off.
   - The display reports necessary information about the amplification level, filter setting, battery level, heart rate, and Bluetooth connection, and does so using icons to maximize the amount of information displayed on the small screen.
   - The brightness of the display enables the user to see the readings and icons at low ambient light levels.

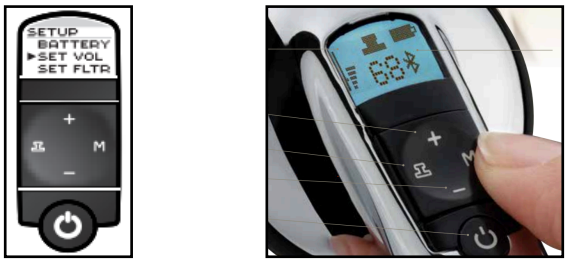
Image of the LCD display.

6. The device provides feedback to the user about potential problems, thus assisting their resolution.
   - The device provides multiple reminders when the battery life is low, so the user has time to replace the battery.
   - If the device moves out of range from a Bluetooth-paired device, the device emits a rapid series of beeps, so the user can prevent the connection from being lost.
7. The default filter and default amplification level can be customized according to the most common use and the use environment, saving time between uses.
8. The use of a replaceable (AA) battery is effective.
   - The charge will last for months, as opposed to days or weeks, eliminating the hassle of constant recharging which may be forgotten.
   - The device is immediately usable once an expired battery is replaced, so the user does not need to wait for the battery to charge to use the device.
   - The device is compatible with alkaline, lithium, and NiMH (nickel metal hydride) battery types, one of which may be preferable in a different use environment.
9. The device can use Bluetooth to transmit data in near real time for visualization, recording, and analysis, so the user does not need to carry additional equipment to transmit the data (e.g., a USB cable).
10. The device also enables onboard recording and playback, which allows the user to immediately reassess and share sounds without the need of any additional equipment.

OPPORTUNITIES FOR IMPROVEMENT

Human factors experts at Pollex also identified the following opportunities for improvement of the Littmann 3200 stethoscope:

- The size of the LCD screen limits its usability.
  - Only three Main menu options are visible at a time, so the user must scroll through the sequence to reach their destination, which is inefficient and may be time-consuming.
  - Some Main menu functions are abbreviated to conserve space and these function names may be misleading (e.g., "SET VOL" for setting the default amplification level) or unclear (e.g., "BT COMM").
  - Icons are small and subtle changes of amplification level, battery level, and mode may be missed.
- The design of the control buttons may increase use errors.
  - Due to the limited number of buttons, some buttons serve dual-purposes, which may not be intuitive. For example, the "M" button is used to both open the Main menu *and* to select options from the menu; there is no specific "select" button.
  - The buttons are not ordered by hierarchy, so a user may accidentally press the "M" button when attempting to change the Mode because the location of these buttons is not intuitive.
  - Most buttons are placed in a single groove without being outset to distinguish themselves, so the user must be careful not to press multiple buttons at once.



Images of the LCD screen and control buttons

- If the user changes the battery type, the user must indicate this type change in the menu settings, which is not a common behavior and may be forgotten.
- The headset is not exchangeable, so the stethoscope cannot be used in use environments such as in helicopters.
- The device does not provide feedback to the user when heart rate is not measurable other than displaying two dashes (- -), so the user may not know if the problem is due to the heart rate being out of range, to excessive ambient noise, etc, and may not be able to resolve the problem.

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