

logitech®

CREATE A BETTER WORK ENVIRONMENT WITH LOGITECH SILENT TOUCH

silent touch

WHITE PAPER



EXECUTIVE SUMMARY

Since Banbury and Berry first proved the negative impact of noise on human health and productivity, in 1998, multiple studies have confirmed and built on their work. To create a better working environment for you and those around you, Logitech has launched SILENT TOUCH — a proprietary technology that dramatically reduces the noise of keyboards and mice.

The technology uses multiple innovative design solutions and breakthrough sound-dampening structures to make keyboards and mice quieter, while also maintaining the familiar clicking and typing feel. As Logitech, the world leader in mice and keyboards has learned over 35 years, these tactile responses are essential to the experience of mousing and typing. Logitech mice with SILENT TOUCH feature new click switches, low-friction feet, and internal design improvements. Logitech keyboards with SILENT TOUCH feature new dampening materials, refined balance bars and internal designs to make the noise from the keycaps quieter.

A series of extensive tests at Foxconn CMC — an independent internationally accredited acoustic testing lab¹ — has shown that the typing and clicking noise of SILENT TOUCH devices decreased by more than 90% compared to non-silent models.

Capable of eliminating the vast majority of excess noise, SILENT TOUCH technology allows you to focus on work and create quieter, healthier work and life conditions in a home, in a workplace, or in any other computing environment.

SILENCE: IT'S MORE IMPORTANT THAN EVER

According to Julian Treasure, a renowned sound expert, noise affects us physiologically, psychologically, cognitively and behaviourally (Treasure, J. 2009). Being unable to get away from the noise that is mostly unintentional and unpleasant, can be extremely damaging for our health and productivity. Constant repetitive noise such as typing and clicking can be damaging for our health and productivity. Furthermore, in research from Aram Seddigh, improved acoustical conditions lead to less cognitive stress and less disturbance (Seddigh, A. et al. 2015).

The initial study by Banbury and Berry in 1998 showed that productivity is reduced by 66% in open-plan offices—a massive decrease that is mainly due to the negative effects of sound.

¹ Foxconn CMC is recognized by CNAS (China National Accreditation Service for Conformity Assessment). CNAS is a member of International Laboratory Accreditation Cooperation), an international laboratory accreditation scheme operated throughout the world. The purpose of ILAC is to enable standardized testing across countries so that testing methodologies are accepted internationally between members.

Noise and unwanted sounds lead to distraction, annoyance, and even sleep deprivation. To increase productivity and overall well-being, Logitech has introduced the world's first silent mouse to receive the Quiet Mark² certification. Along with SILENT TOUCH mice, Logitech has also released silent keyboards that reduce noise generated by all of their 103 standard keys, including the troublesome space bar. While extremely quiet, Logitech SILENT TOUCH keyboards maintain the typing feel our customers expect from the world's leader in mice and keyboards.

PROBLEM

Mouse and keyboard noise negatively impacts both their users (Maxwell, 2001) and people in the vicinity. This becomes especially problematic with the widespread use of open-space office layouts when the typing and clicking sounds can be highly disturbing to a large group of people. At home, mouse and keyboard noise can prevent other family members from concentrating, resting or even sleeping. Finally, loud typing and clicking sounds are a frequent disturbance on video conferences.

SOLUTIONS FOR KEYBOARD

When it comes to computer keyboards, the noise is not just caused by the finger hitting the keycap. When the keycap touches or impacts the top and main shell of the keyboard, it also generates disrupting sounds. In addition, some keys are louder than others. Normally, big keys like the space bar make more noise because of their larger mass. Many of them also have balance bars (they ensure that opposing sides of a big key move in unison) that create extra noise when the keycaps of big keys are hit during typing. With SILENT TOUCH technology, Logitech has considerably reduced excess sounds caused by both big and small keys.

TECHNOLOGICAL ADVANCEMENTS IN SILENT KEYBOARDS

New designs and damping materials have allowed Logitech to make keycaps quieter—no more extra noise when they touch or impact the top case. Logitech has also refined balance bars for big keys like the space bar, enter key, as well as left and right shift keys. The new torsion design developed by our team drastically reduces the noise of keycaps impacting or touching the balance bar. The result: when you type on Logitech's new SILENT TOUCH keyboards, the sound is hardly noticeable within a 1-meter range in quiet surroundings—all while maintaining the same typing feel as what our customers expect from a Logitech product.

² Quiet Mark is the independent, international approval award programme associated with the UK Noise Abatement Society charitable foundation.

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1. NEW KEYCAP DESIGN WITH DAMPING MATERIAL (PATENT PENDING TECHNOLOGY)

In Logitech’s new silent keyboard design, each keycap has been redesigned with a side profile that

- 1) reduces contact surface area between each keycap and the upper case and the plastic keyboard upper case and
- 2) controls how the keycap interacts with the upper case as the keycap moves. To further reduce typing noise, Logitech’s team has also added the damping material between the keycap and upper case.

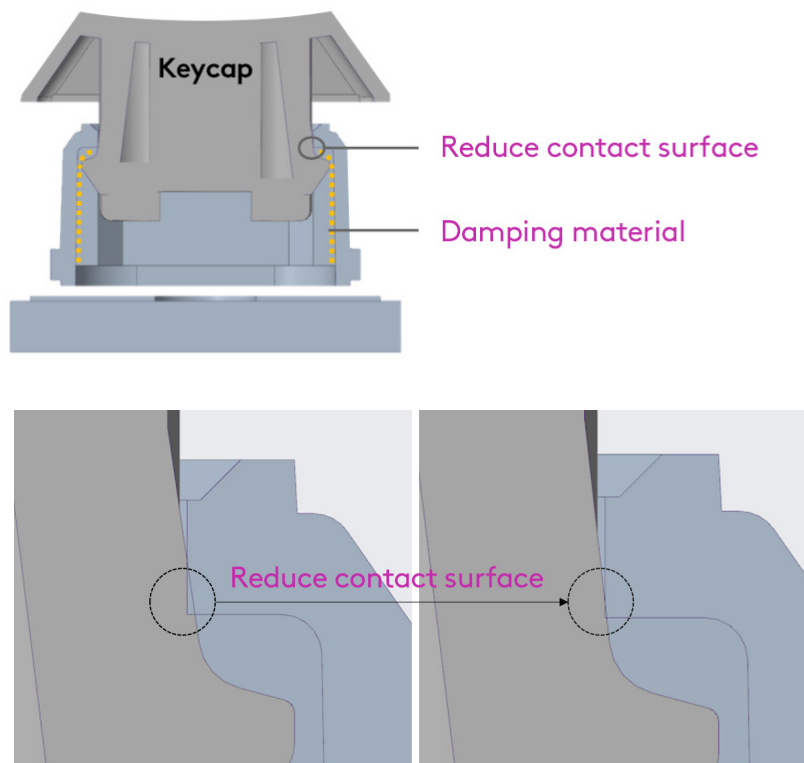


Figure 1: SILENT KEYCAP design with damping material of Logitech MK295

TECHNOLOGICAL ADVANCEMENTS IN SILENT KEYBOARDS

2. BIG KEYS WITH TORSION SPRING (PATENT PENDING TECHNOLOGY)

As we mentioned before, extra typing noise can be created by balance bars. Since big keys like the space bar or enter keys are usually pretty long, balance bars ensure that the opposing sides of these keys move in unison. But there's a problem: when you type and press the big keys, the keycaps and balance bars are not tight and close enough together and thus make additional noise. To reduce tolerances between these two components, Logitech has developed a torsion spring system. The keycaps and balance bars now work seamlessly together, removing the typical noise of the big keys.



Figure 2 Space bar, enter key, left shift key and right shift key all include balance bars.



Figure 3. Torsion spring structures implemented in big keys



Figure 4 Torsion spring structure design helps to reduce noise by holding the balance bar and keycap tightly together

SOLUTIONS FOR MICE

In computer mice, sound comes from three distinct sets of components:

- 1) the switches, when clicking on the left, right or middle button,
- 2) the feet, when gliding the mouse on a mousepad or table, and
- 3) empty chambers within mice that can resonate or otherwise amplify sound.



Figure 5: Bottom and side views of Logitech M220

Through technological advancements, Logitech has considerably reduced the sound emitted by these components.

TECHNOLOGICAL ADVANCEMENTS

1. SWITCHES

The switches used in Logitech's Silent Mice include a rubber actuator that dampens both vibration and sound. A red plastic cap covers the rubber actuator to improve the switch's tactile feedback and lengthen its lifespan. The switches used by Logitech have a lifespan of 5 million cycles, on par or often better than most of the non-silent mice found on the market today.

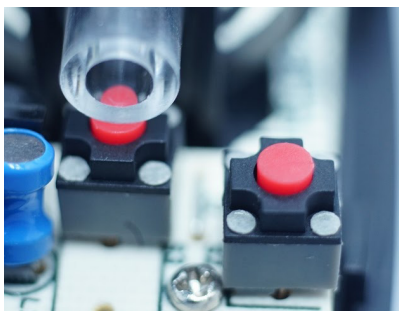


Figure 6: Assembled silent switches

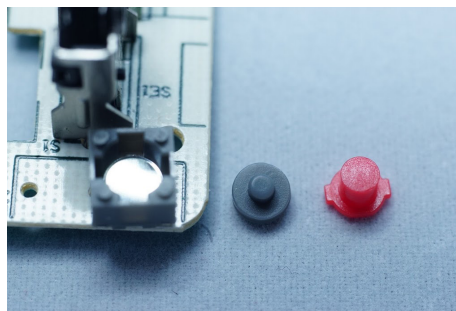


Figure 7: Dismantled silent switches

The new switches significantly reduce clicking sounds while keeping a tactile feedback similar to that found in non-silent models.

2. FEET

For Silent Mice, Logitech opted for Plastic Lumber (PL) material, which proves quieter and more durable than other materials such as Unsaturated Polyester (UPE) and Polytetrafluoroethylene (PTFE).

3. PLASTIC PART DESIGN

Most mice include a large empty internal cavity. While it is often necessary to design a computer mouse with a certain internal empty volume to achieve the desired comfort level, this empty chamber also amplifies noise generated by clicking switches, scrolling wheels and gliding feet. To further reduce the noise level, Logitech strategically places plastic ribs within its Silent Mice. Like a noise barrier on the side of the highway, these inner walls dampen sound and reduce echos that propagate within the mouse.

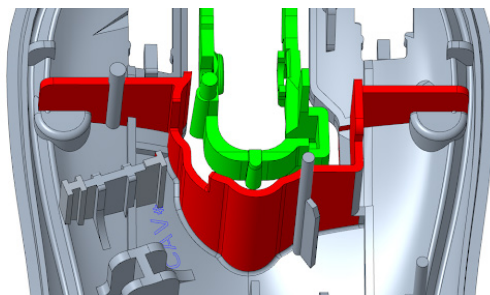


Figure 8: Red parts show noise-dampening ribs inside Silent mouse

METHODOLOGY AND RESULTS

Acoustic measurements of Logitech Silent and Non-Silent models were conducted by Foxconn CMC, an independent lab located in Suzhou, China.

To follow the ISO7779 measurement condition, the sound equipment was placed 1 meter from the center of the keyboard and mouse. Measurements were taken at four different angles around these devices.



Figure 7: Testing setup at Foxconn CMC anechoic chamber with < 6 dBA background noise

Sound pressure level (SPL) or acoustic pressure level is a logarithmic measure of the effective pressure of a sound relative to a reference value. It is measured in dB. A-weighted sound measurements (dBA) are filtered to reduce the effect of very low and very high frequencies, better representing human hearing. With A-weighting, sound monitoring equipment approximates the human ear's sensitivity to the different frequencies of sound.

The lab tested two Logitech keyboard and mouse combos: a silent MK295 (K295 silent keyboard/M220 silent mouse) and non-silent MK270 (K270 keyboard/M185 mouse), the world's best-selling combo³.

The results after testing the standard keys in both combos showed that the silent keyboard was ten times quieter than the non-silent one. The K295 keyboard's average Sound Pressure Level (SPL) was 16.90 dBA whereas the non-silent K270 was 30.05 dBA—a massive difference human ears can clearly perceive.

³ Logitech MK270/MK275 is the world's best selling combo based on independent sales data (in units) aggregated from major global markets including Canada, China, France, Germany, Indonesia, Japan, Korea, Russian Federation, Sweden, Taiwan, Thailand, Turkey, UK, US (Dec'18 - Dec'19 period). Retail channel only. Combos aggregated. MK275 is aggregated with MK270 in units as Logitech MK275 is color derivative of MK270.

METHODOLOGY AND RESULTS

The average results for clicks, show that the Sound Pressure Level (SPL) was 24.25 dBA for the Logitech M220 Silent mouse while the measurement for the Logitech M185 was 36.65 dBA, which is more than a 90% noise reduction.

Along with **Sound Pressure Level** (SPL), the noise reduction of SILENT TOUCH can be expressed by **Sound Power Level** (SWL). While **Sound Pressure Level** is measurable, **Sound Power Level** is used to describe the acoustic energy emitted by a source. SPL depends on the distance from the source whereas SWL focuses more on conditions of how the sound propagates from the source. The following formula determines the relationship between Sound Power Level (SWL) and the measured **Sound Pressure level** (SPL).

$$SWL = SPL + 10 \cdot \log \left(\frac{Q}{4\pi \cdot r^2} \right)$$

Where

SWL is the Sound Power Level of the source

SPL is the measured Sound Pressure Level

Directivity factor $Q=2$ (half spherical propagation, for a device laid on a table)

$r = 1$ m, the distance to the sound source,

The noise level reduction from the reference is then calculated with the difference found in Sound Power Levels, according to

$$\text{Noise reduction} = [1 - 10^{(\Delta_{SWL}/10)}] \cdot 100$$

where

Δ_{SWL} is the **Sound Power Level** difference between two models

The noise reduction between the Logitech K295 Silent keyboard and Logitech K270 keyboard was 95%. The noise reduction between the Logitech M220 mouse and Logitech M185 mouse was 94%.

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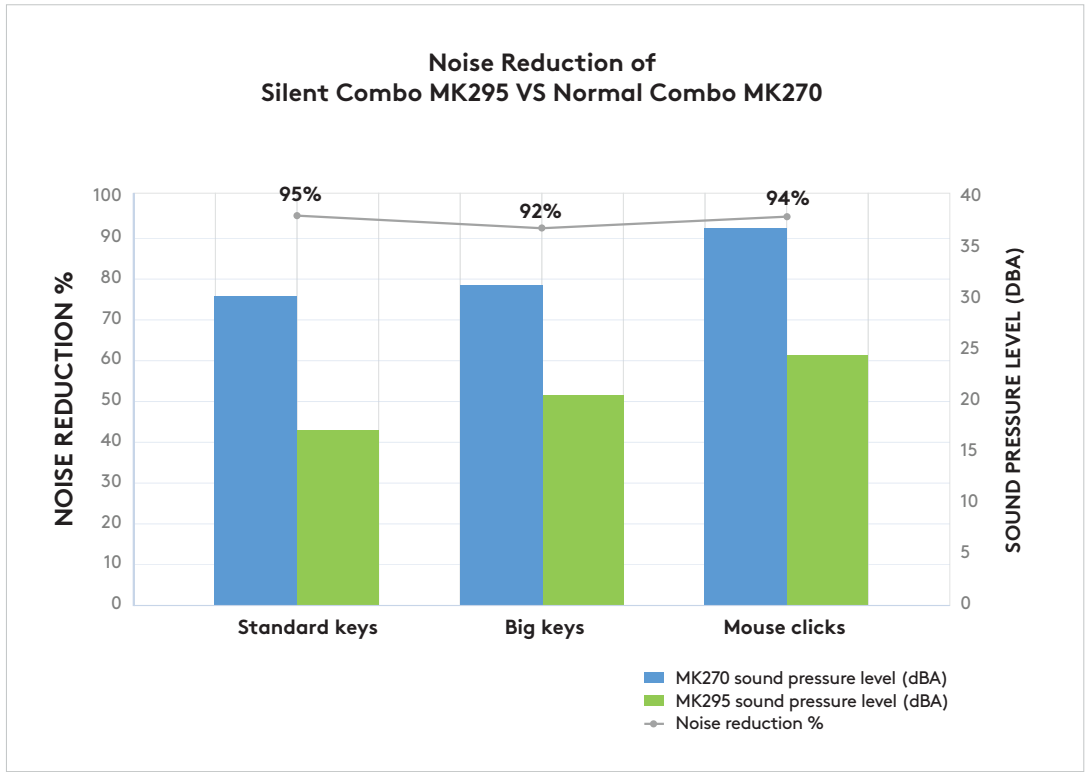


Figure 8 - Noise reduction test of MK295(Silent keyboard & mouse) vs MK270(Normal keyboard and mouse)

CONCLUSION

Logitech has developed breakthrough, patent-pending SILENT TOUCH technologies that significantly reduce keyboard and mouse noise while maintaining the familiar typing and clicking feel. From studying what causes the noise to deploying innovative design solutions and materials, Logitech took a holistic approach that resulted in over 90% of keyboard and mouse noise reduction (the results were verified by an internationally-accredited acoustic testing lab). With a quieter keyboard and mouse experience, SILENT TOUCH creates a more productive, healthier environment for you and those around you.



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