GMMK Pro Mechanical Keyboard

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Computer keyboards are tools that are used to print characters onto a screen paired with a computer and mouse. The history of the modern keyboard begins with the inheritance of the typewriter that utilized the QWERTY layout patented by Christopher Latham Sholes in 1868, and soon after in 1877, the Remington Company began mass marketing of the first typewriters. The typewriter allowed people to create writing at a much quicker pace in comparison to writing by hand. This foundational invention laid the groundwork for the development of the modern computer keyboard, evolving through several phases to adapt to the increasing demands of computer users for speed, reliability, and comfort. Mechanical keyboards, emerging in the 1970s, marked a significant milestone. Renowned for their durability, tactile feedback, and typing precision, mechanical keyboards became a preferred choice for gamers, typists, and professionals alike, signaling a new era in the design and functionality of computer keyboards. A key aspect that sets the mechanical keyboards apart is their customization potential. Users can customize almost every aspect of the mechanical keyboard allowing for a variety of different keyboards. This technical description will be on the GMMK Pro Mechanical Keyboard.

The GMMK Pro Mechanical Keyboard, as shown in Figure 1, is a customizable keyboard offered by the company called Glorious Gaming, which sells a variety of products related to PC gaming including mice, accessories, mouse pads, and keyboards. The keyboard itself can be fully customized on their website allowing the user to choose each part individually and build it themselves. This keyboard has a 75% layout which is a compact version of a standard keyboard that includes about 75% of the keys normally found on a full-size keyboard. It includes a function row, arrow keys, and a compact set of navigation keys. The product has a total of 17 parts covering 9 main parts: the Rotary Encoder, Keycaps, Mechanical Switches (with subparts: Top Housing, Stem, 60 G Spring, Leaf, and 5-Pin Bottom Housing), Goat Stabilizers GSV2

(with subparts: Wire and Housing), Gasket Mounted Switch Plate, 5-Pin Modular PCB (with the subpart: 32-Bit ARM, and RGB Lighting), CNC Aluminum Case, and the Fully Machined Case.

Figure 1: GMMK Pro Mechanical Keyboard fully built.

Rotary Knob

The rotary knob on the GMMK, as shown in Figure 2, has a cylindrical shape in the color black slate. It has rigid texture on the sides of the knob but smooth on the top and is made fully from aluminum. The height measures 14.5 mm, outer diameter is 18 mm, and the inner diameter is 14.5 mm. The purpose of the rotary knob is to provide users with versatile control for adjusting volume, scrolling through pages, or customizing other functionalities. The rotary knob on a keyboard is connected to the keyboard's main circuit board (PCB), allowing it to interface with the computer's operating system and software. Through this connection, the rotary knob can send specific input signals when turned or pressed, which are then translated into actions.

Figure 2: Black slate rotary knob made from aluminum.

Keycaps

The black ash GPBT keycaps, as shown in Figure 3, are made from PBT plastic, also known as polybutylene terephthalate plastic which is chemically resistant to solvents and oils. It is also highly resistant to extreme temperatures and discoloration from UV radiation exposure. Keycaps are cube-like in shape with the larger keys like backspace, spacebar, enter, tab, caps, and shift being more rectangular. The Glorious keycap set is cherry profile, which features a slight curve and angled shape that is designed to fit the natural curvature of the fingers, as shown in Figure 3.1. Keycaps come at four different heights: R1, R2, R3, and R4 each representing different rows of the keyboard, as shown in Figure 3.2. R1 keycaps are the lowest and are typically used for the bottom row of a keyboard and are 7.9 mm curving up to 10.10 mm. R2 keycaps are slightly taller and are used for the second row from the bottom and are 8.0 mm curving up to 9.3 mm. R3 keycaps are taller than R2 and are used for the third row from the bottom and are 9.0 mm curving slightly up to 9.3 mm. Finally, R4 keycaps are the tallest and are used in the top row of the keyboard and are 11.4 mm curving down to 10.8 mm. All 4 versions of

the standard square keycaps are 18.0 mm in length and 18.0 mm in width as shown in Figure 3.3. The spacebar is the longest keycap with a length of 118.30 mm, a width of 18.0 mm, and a height of 7.9mm curving up to 10.10 mm as shown in Figure 3.4. The left and right shift are both R1 keycaps with the same height and width, but the left shift is 41.8 mm in length and the right shift is 51.4 mm in length as shown in Figure 3.5. The tab and the backslash are both R3 keycaps with the same height and width but have a length of 27.5 mm as shown in Figure 3.6. The enter is a R2 keycap with the same height and width however it has the same measurement for length as the left shift at 41.8 mm. Keycaps are the physical interface between the user and the keyboard, designed to cap the individual mechanical switches that register keystrokes. When a keycap is pushed down, the switch activates the keystroke. They are connected to mechanical switches, in particular the stem, and help facilitate the accurate and responsive input necessary for all typing tasks. Beyond their functional role in signal translation, keycaps also serve an aesthetic and informative purpose. They are often customized in terms of material, shape, and color.

Figure 3: Glorious GPBT black ash key caps.

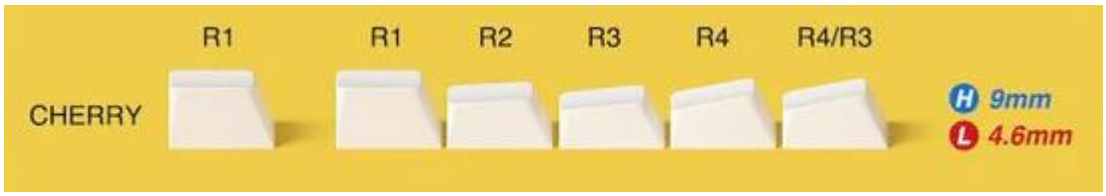

Figure 3.1: Cherry profile shape

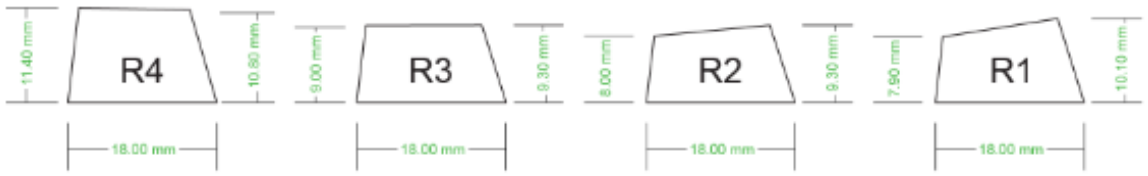

Figure 3.2: Measurements of the different rows of keycaps.

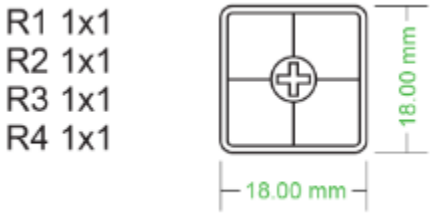

Figure 3.3: Length and width of standard square keycaps.

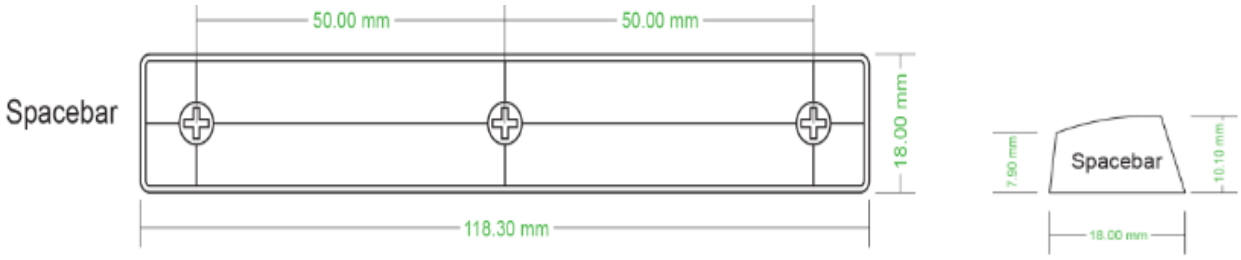

Figure 3.4: Measurement of the spacebar keycap.

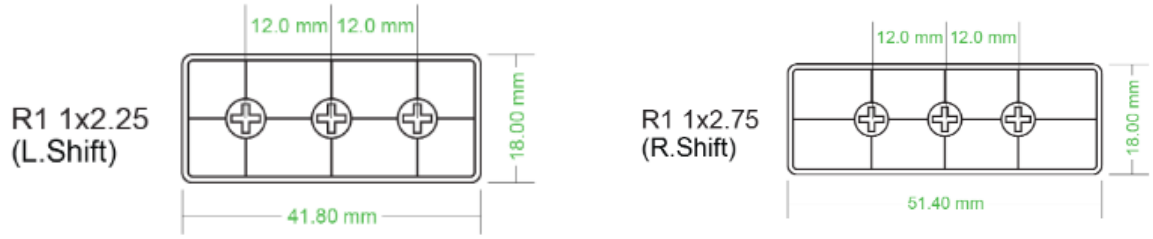

Figure 3.5: Measurements of the Left and Right shift keycaps.

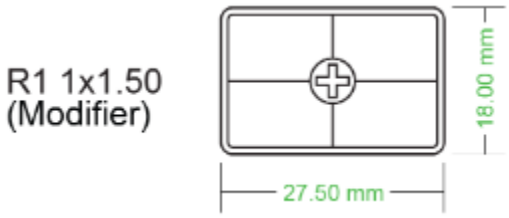

Figure 3.6: Measurement of the tab and backslash keycap.

Mechanical Switches

Mechanical switches are the core components of a mechanical keyboard, responsible for the device's key actuation and distinctive typing experience. This mechanical switch comes in the type linear. Linear switches are smoother with no bump feeling. The switch snaps onto the switch plate and is connected to the PCB board and sends signals to this board signifying that a key has been pressed. The mechanical switch used in the GMMK Pro are the Glorious Lynx Linear Switches, as shown in Figure 4, is composed of 5 subparts: Top Housing, Stem, 60g Spring, Leaf, and 5-pin Bottom Housing.

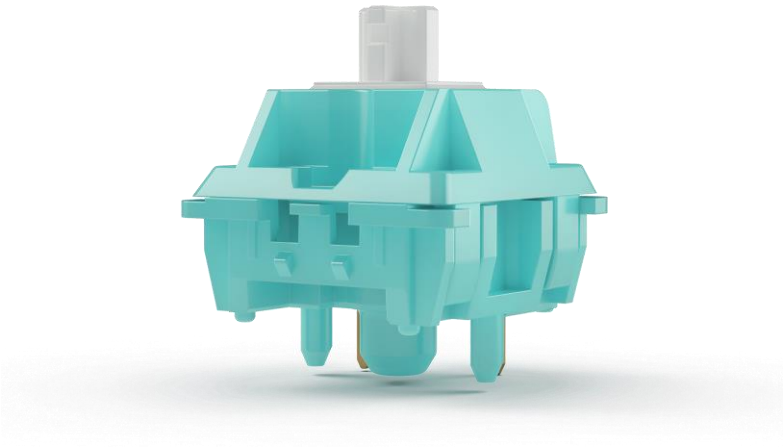

Figure 4: Glorious Lynx Linear Switches

Top Housing

The top housing as shown in Figure 4.1, is a light blue color made from polycarbonate thermoplastic that serves as the case for the Stem, Spring, Leaf, and is connected to the 5-pin Bottom Housing. The top housing serves the purpose of protection as well as holding all the other parts of the switch.

Figure 4.1: The Top Housing of the linear switch

Stem

The stem as shown in Figure 4.2, is white and made from low-friction POM, or Polyoxymethylene. This is a crucial part of the switch as it is the moving part that descends when a key is pressed and returns to its original position when released. The movement of the stem compresses the spring underneath and is connected to the leaf, that eventually closes the electrical circuit registering a keystroke. The design of the stem influences the type of tactile feedback the user receives. Since this is a linear switch, the stem is designed to provide a smooth, linear path for consistent resistance. The stem helps to keep the keycap aligned and stable during presses, minimizing wobble.

Figure 4.2: The Stem of the linear switch

60 G Spring

The 60 G spring as shown in Figure 4.3, is designed using nickel plated stainless steel. The purpose of a spring in a mechanical switch is to provide resistance against the keypress and to return the key to its original position after actuation. The weight of the spring, in this case 60 G, indicates the actuation force required to press the key and affects how heavy or light a key feel.

Figure 4.3: 60 G Spring of the linear switch

Leaf

The leaf of the switch as shown in Figure 4.4, is made from copper and it serves the purpose as the contact point with the switch. When the switch is pressed, the stem moves down and forces the leaf to connect with another contact point, completing the electrical circuit and registering the keypress to the computer. The leaf is housed within the bottom housing of the switch.

Figure 4.4: Leaf of the linear switch

5-Pin Bottom Housing

The 5-Pin Bottom Housing as shown in Figure 4.5, is made of nylon and serves the purpose of enhancing stability, connectivity, and compatibility with keyboards. The 5 Pins are designed to securely anchor the switch to the PCB. The 5-pin design is compatible with a wider range of PCBs including those designed for both 5-pin and 3-pin switches. It is connected to the

top housing and snaps together to form a case for the parts inside providing protection and stability.

Figure 4.5: 5-Pin Bottom Housing of the linear switch.

Goat Stabilizers GSV2

Stabilizers, often referred to as “stabs” are components designed to provide support and stability to the larger keys on a keyboard, such as the spacebar, enter, shift, and backspace keys. Without stabilizers these larger keys would wobble or stick when pressed off center leading to an inconsistent and unsatisfying typing experience. The Goat Stabilizers GSV2 as shown in Figure 5, are PCB-mounted and need to be screwed in directly to the board. The stabilizers consist of 2 subparts, the wire and the housing that holds the wire.

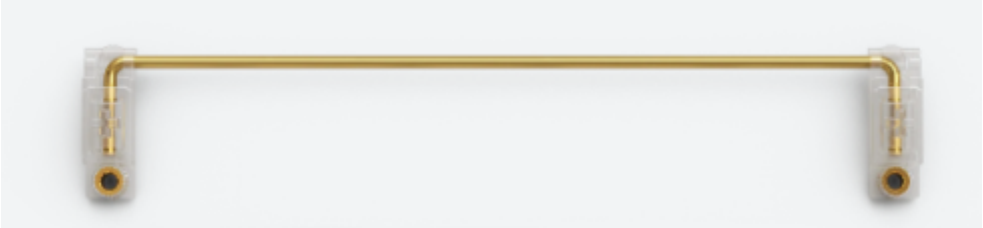

Figure 5: The Goat Stabilizers GSV2 with gold plated wire

Wire

The wire as shown in Figure 5.1, is gold plated and has 3 different lengths for stabilizers. The shortest wire has a length of 25.60 mm, and the next wire has a length of 101.60 mm, and the largest wire has a length of 116 mm. The primary function of the wire in stabilizers is to transfer the motion from one side of the large key to the other. When a large key is pressed from the end, the wire ensures that the opposite end moves down simultaneously, resulting in uniform and stable keystrokes.

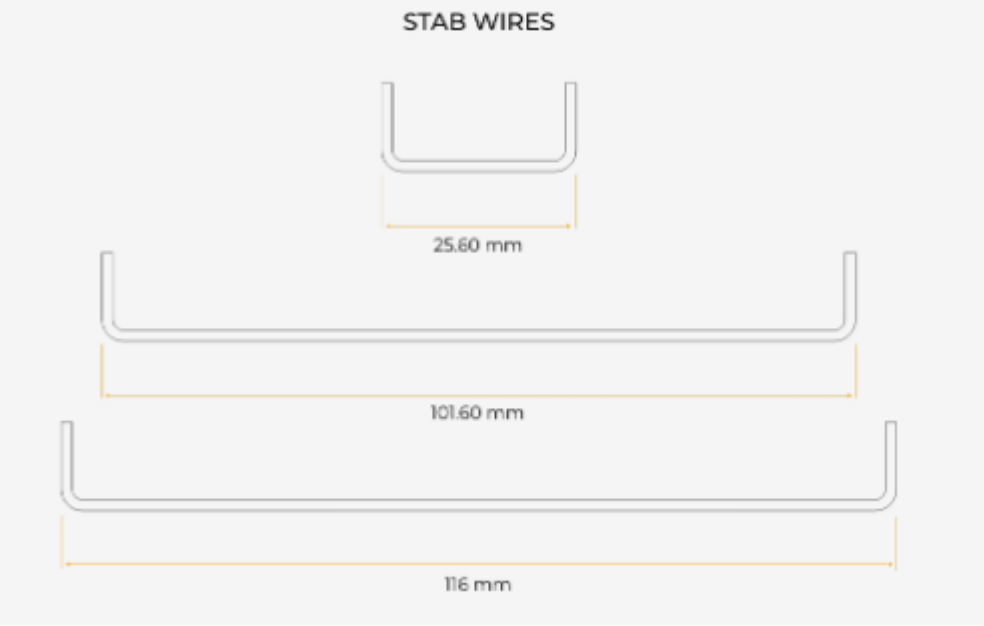

Figure 5.1: The 3 different lengths of wires for the stabilizers.

Housing

The housing as shown in Figure 5.2, is made of polymer plastic and is translucent. It has a length of 19.6 mm and a width of 6.25 mm. The housing serves as the protective shell for the wire as well as holding the wire securely in place. It allows the stabilizer to be mounted onto the PCB board providing support. At the ends of the housing there are holes that allow for the screw to be inserted.

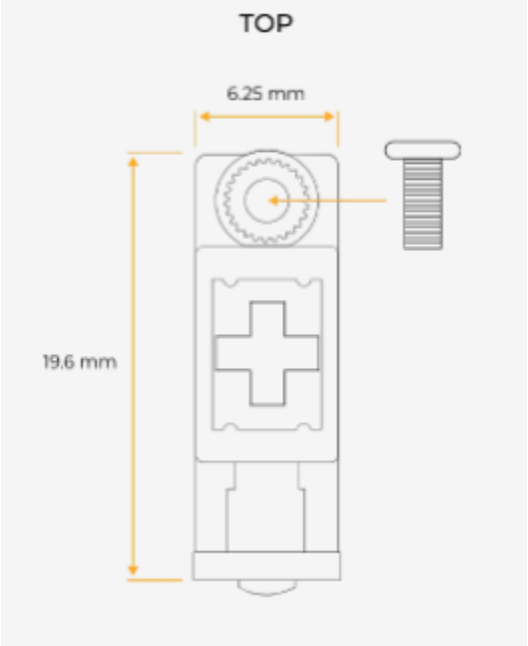

Figure 5.2: A top-down view of one side of the polymer housing.

Gasket Mounted Switch Plate

The Gasket Mounted Switch Plate as shown in Figure 6, is made entirely of brushed-gold brass. The material creates a higher musical tone when the switch strikes the plate or “bottoms out”. The switch plate is a component that is connected to the keyboard’s PCB as it rests on top of it, in between the switches, adding rigidity to the board and protecting the PCB from the repeated stress of keystrokes, as well as from dirt and dust. The main purpose is to provide a mounting framework for the switches, ensuring that they are securely and accurately positioned onto the PCB.

Figure 6: A full brass switch plate

The term “gasket mounted” refers to the way that the plate is secured into the keyboard housing. A gasket mount as shown in Figure 6.1, uses gasket material between the plate and the keyboard housing on both top and bottom sides. It gives the board a more cushioned feel since the plate isn’t directly in contact with the other metal components of the keyboard.

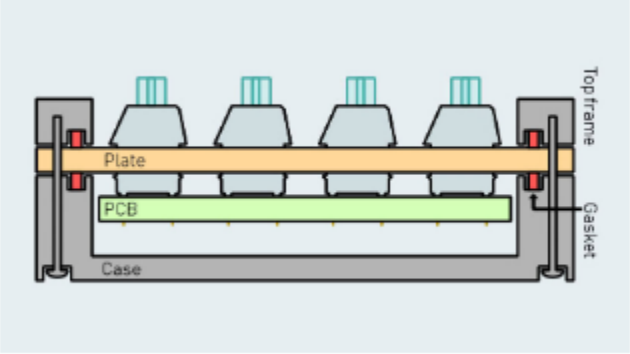

Figure 6.1: The red indicates the gaskets being used to separate the plate from the other parts of the keyboard.

5-Pin Modular PCB

The 5-pin Modular PCB as shown in Figure 7, is a fully black board with white outlines. The PCB is essentially the brain of the keyboard and contains the circuitry, resisters, and diodes that convert keypresses into electrical signals and send them to a computer. It is made from glass fiber with copper traces. Diodes are the one-way valves of electronics. They let electricity flow in one direction only and this prevents ghosting. Ghosting is when multiple keys are pressed together, and the keyboard struggles to differentiate between keys that have been pressed. The 5-pins that the GMMK Pro has allow for more versatility. 2 of the five pins are used for the electrical connections necessary to register keypresses. When the key is pressed, the circuit completed by these two pins sends a signal to the keyboard's microcontroller, which then communicates the keypress to the computer. The remaining 3 pins are designed to enhance the physical stability of the switch when mounted onto the keyboard's PCB. It reduces the likelihood of the switch wobbling. The 5-pin PCB can accommodate both 5-pin and 3-pin switches. This PCB is also hot swappable, which means that the switches can be inserted or removed from the PCB without the need for soldering, which is achieved through sockets that are pre-installed onto the PCB, which accept the pins of mechanical switches. The PCB is placed onto the bottom case.

Figure 7: Black 5-pin Modular PCB Board

32-Bit ARM

The PCB for the GMMK Pro uses a 32-Bit ARM processor as shown in Figure 7.1. It is black and square in shape with pins on the edges. It is a powerful microcontroller that manages the functions and features. It is essentially a computer on its own with integrated CPU, memory, and storage space all in a tiny socket of 7x7 mm. It runs firmware to detect keypresses. When a key is pressed, a signal is first sent to the processor then the ARM processor interprets the signal, determining which key is pressed and sends the information to the computer. It is also in charge of any RGB lights on the computer. The GMMK Pro uses the 32-Bit ARM processor from STelectronics.

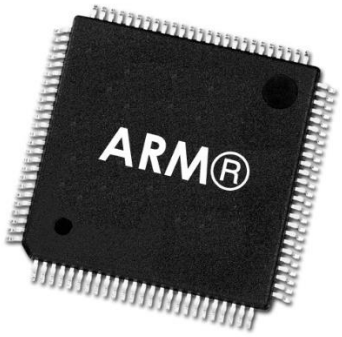

Figure 7.1: The ARM Cortex M3 Processor from STelectronics

RGB Lighting

RGB Lighting on a keyboard refers to the inclusion of Red, Green, and Blue LEDs, which can produce a wide spectrum of colors. For the GMMK Pro the LED's are on the PCB board itself and are controlled by software from the user. The processor can interpret inputs from the software and set the LEDs accordingly. The GMMK pro has a plastic strip as shown in Figure 7.2, along the side of the case allowing for RGB light to shine through the side of the keyboard as well.

Figure 7.2: Plastic strip running along the side of the case allowing for RGB to shine through.

CNC Aluminum Case

The CNC Aluminum Case as shown in Figure 8, is also referred to as the top frame, which is colored in black slate and made fully from aluminum. It has a length of 332 mm and a width of 134.8 mm. The top case provides a protective shell for the keyboard's internal components such as the PCB and Switches. It also contains the mounting framework for the keyboard's switches and keycaps, ensuring they are securely and accurately positioned. It is directly connected to the bottom case with screws encasing all the internal parts of the keyboard.

Figure 8: Aluminum Top Frame for the GMMK Pro

Fully Machined Case

The Fully Machined Case as shown in Figure 9 is also referred to as the bottom frame, which is colored in black slate and fully made from aluminum has the same measurements as the top frame with a length of 332 mm and a width of 134.8 mm. When connected to the top frame

the heigh of the combined shell is 32 mm. The bottom frame like the top frame provides protection for the internal parts, however the bottom frame is the main foundation of the entire keyboard. Everything is placed onto the bottom frame, and it is crucial for maintaining the integrity of the keyboard under the stress of regular use. It also has rubber pads attached to the bottom to prevent sliding across surfaces.

Figure 9: The bottom frame of the GMMK Pro

The GMMK Pro is a fully customizable keyboard, offered by Glorious Gaming. It features a 75% layout retaining its function keys, arrow keys, and a compact set of navigation keys. Distinct features of this keyboard include a Rotary Encoder, which is configurable for multiple uses such as volume control or scrolling. The keyboard's structure is fortified by a CNC Aluminum Case and the mechanical switches are hot-swappable meaning that they can be easily changed and replaced. This keyboard also contains RGB lighting under the keys as well as on the side of the keyboard. There are many features to the GMMK Pro tailored to offer a unique experience.

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