

Description

Title of Invention: ANALOG INPUT DEVICE, SYSTEM FOR RECEIVING AND PROCESSING ANALOG INPUT

Technical Field

[0001] Various embodiments generally relate to an analog input device and a system for receiving and processing analog input.

Background

[0002] Conventionally, input devices such as gaming controller, gaming keypad, keyboard, or mice includes buttons or keys are coupled to digital switches. These digital switches only output binary signal, and limits the achievable functions of the input devices and possible user intents. For example, in gaming, more granularity of the analog input may be preferred for more precise control of a magnitude for a character's speed, directions, movements, actions etc. Such controls are typically not achievable with binary input devices. Traditionally, an analog input key needs to travel past a fixed actuation point for a keystroke to be registered. For the next keystroke to be made, the input key needs to first reset by travelling back up past its fixed reset point.

[0003] Accordingly, there is a need for a more effective analog input device.

Summary

[0004] According to a first aspect of the present disclosure, there is provided an analog input device. The analog input device may include a plurality of analog input keys; a display having a plurality of indicators; and controls configured to adjust a setup value of the analog input keys, wherein the plurality of indicators are configured to turn on to represent the setup value of the plurality of analog input keys.

[0005] According to a second aspect of the present disclosure, there is provided a system for receiving and processing analog input. The system may include an input module configured to receive analog input from a plurality of analog input keys and inputs from controls configured to adjust a setup value of the plurality of analog input keys; an output module configured to output control signal to a plurality of indicators; and wherein the output module is configured to turn on the plurality of indicators to represent the setup value of the plurality of analog input keys.

Brief description of the drawings

[0006] In the drawings, like reference characters generally refer to the same parts throughout the different views. The drawings are not necessarily to scale, emphasis instead generally being placed upon illustrating the principles of the invention. In the

following description, various embodiments are described with reference to the following drawings, in which:

- [0007] FIG. 1 shows a schematic diagram of an analog input device according to various embodiments;
- [0008] FIG. 2 shows a schematic diagram of an analog input device according to various embodiments;
- [0009] FIG. 3 shows a schematic diagram of an analog keyboard as an example of the analog input devices of FIGS. 1 and 2 according to various embodiments;
- [0010] FIG. 4 shows a schematic diagram of a display of the analog input device of FIG. 3 in an adjustment mode according to various embodiments;
- [0011] FIG. 5 shows a schematic diagram of a system for receiving and processing analog input according to various embodiments;
- [0012] FIG. 6 shows a flow chart depicting adjustment steps in an actuation point adjustment mode of an analog keyboard according to various embodiments; and
- [0013] FIG. 7 shows a flow chart depicting adjustment steps in a rapid trigger sensitivity adjustment mode of an analog keyboard according to various embodiments.

Detailed description

- [0014] Embodiments described below in the context of the apparatus are analogously valid for the respective methods, and vice versa. Furthermore, it will be understood that the embodiments described below may be combined, for example, a part of one embodiment may be combined with a part of another embodiment.
- [0015] It should be understood that the terms “on”, “over”, “top”, “bottom”, “down”, “side”, “back”, “left”, “right”, “front”, “lateral”, “side”, “up”, “down” etc., when used in the following description are used for convenience and to aid understanding of relative positions or directions, and not intended to limit the orientation of any device, or structure or any part of any device or structure. In addition, the singular terms “a”, “an”, and “the” include plural references unless context clearly indicates otherwise. Similarly, the word “or” is intended to include “and” unless the context clearly indicates otherwise.
- [0016] It will be further understood that the terms “comprise” (and any form of comprise, such as “comprises” and “comprising”), “have” (and any form of have, such as “has” and “having”), “include” (and any form of include, such as “includes” and “including”), and “contain” (and any form of contain, such as “contains” and “containing”) are open-ended linking verbs. As a result, a method or device that “comprises,” “has,” “includes” or “contains” one or more steps or elements possesses those one or more steps or elements, but is not limited to possessing only those one or more steps or elements. Likewise, a step of a method or an element of a device that

“comprises,” “has,” “includes” or “contains” one or more features possesses those one or more features, but is not limited to possessing only those one or more features. Furthermore, a device or structure that is configured in a certain way is configured in at least that way, but may also be configured in ways that are not listed.

- [0017] Approximating language, as used herein throughout the specification and claims, may be applied to modify any quantitative representation that could permissibly vary without resulting in a change in the basic function to which it is related. Accordingly, a value modified by a term or terms, such as “about,” “substantially”, is not limited to the precise value specified but within tolerances that are acceptable for operation of the embodiment for an application for which it is intended. In some instances, the approximating language may correspond to the precision of an instrument for measuring the value.
- [0018] As used herein, the phrase of the form of “at least one of A or B” may include A or B or both A and B. Correspondingly, the phrase of the form of “at least one of A or B or C”, or including further listed items, may include any and all combinations of one or more of the associated listed items.
- [0019] As described herein, a processor (or a processing unit or a host processing unit or a host processor etc) may be understood as any kind of a logic implementing entity, which may be special purpose circuitry or a processor executing software stored in a memory, firmware, or any combination thereof. Thus, the processor may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor (e.g. Programmable Logic Controller (PLC)), e.g. a microprocessor (e.g. a Complex Instruction Set Computer (CISC) processor or a Reduced Instruction Set Computer (RISC) processor) . The processor may also be a processor executing software, e.g. any kind of computer program, e.g. a computer program using a virtual machine code such as e.g. Java.
- [0020] Various embodiments generally relate to an analog input device. In particular, various embodiments generally relate to an analog input device comprising a display having a plurality of indicators; and a plurality of analog input keys. The plurality of indicators may be configured to turn on to represent a setup value of the plurality of analog input keys (e.g. when a mode of a plurality of modes is activated) . The plurality of modes may include an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode. In some embodiments, a respective combination of analog input keys may be used to activate a respective mode, for example, in the context of a keyboard, Fn + Tab may be used to activate the actuation point adjustment mode. In some embodiments, when a respective mode is activated, the plurality of indicators may be turned on in a mode presenting way, for example, in the context of the plurality of indicators being a LED indicator, a respective LED of the LED

indicator may be turned on in a respective colour (e.g. in green for the actuation point adjustment mode, in orange for the rapid trigger sensitivity adjustment mode), showing a setup value of the respective mode. In various embodiments, the plurality of indicators may be arranged sequentially associated with threshold values thereof. Accordingly, the LED indicator may function as a LED meter showing visual display of quantitative information of setup values of the plurality of modes.

[0021] In various embodiments, when a respective mode is activated (e.g. when an adjustment mode is on), the plurality of analog input keys may be disabled, e.g. may not register any input, except designated actuation keys (e.g. arrow keys). The proposed analog input device may further include a lighting arrangement including backlighting for the plurality of analog input keys, and/or underglow lighting for the analog input device. Accordingly, when a respective mode of a plurality of modes is activated, the plurality of analog input keys may show static lighting effect (e.g. corresponding green effect for the actuation point adjustment mode, corresponding orange effect for the rapid trigger sensitivity adjustment mode). Further, if a respective mode may be enabled or disabled (e.g. the rapid trigger sensitivity adjustment mode) by an analog input key or a combination of analog input keys (e.g. Caps Lock), the plurality of analog input keys may show static lighting effect in full (e.g. 100%) brightness when the respective mode is enabled and in partial (e.g. 20%) brightness when the respective mode is disabled. A corresponding indicator of the plurality of indicators may remain showing the setup value of the respective mode regardless the mode being enabled or disabled.

[0022] In various embodiments, the plurality of indicators may be associated with different threshold values in different modes of the plurality of modes in connection with the travel distance of the plurality of analog input keys (e.g. including a maximum of the travel distance). For example, in the actuation point adjustment mode, the threshold values may be in the range of 0.1 mm to 3.6 mm (e.g. close to the maximum of the travel distance) when the maximum of the travel distance is 4.0 mm; in the rapid trigger sensitivity adjustment mode, the threshold values may be in the range of 0.1 mm to 2.4 mm (e.g. close to half of the maximum of the travel distance) when the maximum of the travel distance is 4.0 mm. In various embodiments, the travel distance may be directional, for example, the travel distance of the plurality of analog input keys may have an up direction (travelling toward to a default position, releasing) and a down direction (travelling away from the default position, actuating). Accordingly, the plurality of indicators may be turned on in different colours for releasing (e.g. in red) and actuating (e.g. in green) of the plurality of analog input keys in the mode adjusting way while a respective mode is activated, in which releasing and actuating of the plurality of analog input keys is respectively considered. Additionally or

alternatively, while a respective mode (e.g. the rapid trigger sensitivity adjustment mode) is activated, in which releasing and actuating of the plurality of analog input keys is respectively considered, the plurality of indicators may not be turned on and instead the plurality of analog input keys (e.g. the selected number of the plurality of analog input keys) may be turned on in different colours for releasing (e.g. in red) and actuating (e.g. in green) of the plurality of analog input keys in the mode adjusting way for preview.

- [0023] In various embodiments, an adjusted setup value may be saved and supersede the previous setup value in the software (firmware) for the plurality of analog input keys (e.g. globally adjusted) .
- [0024] In some instances, aspects of the systems and techniques described here provide technical improvements and advantages over existing approaches. For example, the proposed analog input device provides an advantageous way for a user of the analog input device to adjust (e.g. edit, update) system values (e.g. variables, parameters) used in a software (firmware) by the plurality of analog input keys of the analog input device. Accordingly, the user may remain in the present application (e.g. a game) and not need to open the software (firmware) window to adjust (e.g. edit, update) system values (e.g. used in the present application) by the plurality of analog input keys of the analog input device, whereby the proposed analog input device provides an efficient way.
- [0025] The following examples pertain to various embodiments.
- [0026] Example 1 is an analog input device including: a plurality of analog input keys; a display having a plurality of indicators; and controls configured to adjust a setup value of the analog input keys, wherein the plurality of indicators are configured to turn on to represent the setup value of the plurality of analog input keys.
- [0027] In Example 2, the subject matter of Example 1 may optionally include that a respective indicator of the plurality of indicators is associated with a respective threshold value in connection with a travel distance of the plurality of analog input keys.
- [0028] In Example 3, the subject matter of Example 2 may optionally include that the respective indicator of the plurality of indicators is configured to turn on when the travel distance of the plurality of analog input keys exceeds that threshold value associated with the respective indicator.
- [0029] In Example 4, the subject matter of Example 1 may optionally include that when a mode of a plurality of modes is activated, a corresponding indicator of the plurality of indicators with which a threshold value associated is configured to turn on in a mode presenting way, and a setup value of the mode is equal to the threshold value associated with the corresponding indicator.

- [0030] In Example 5, the subject matter of Example 4 may optionally include that when the mode is activated, the plurality of indicators are further configured to turn on in a mode adjusting way in response to a travel distance of the plurality of analog input keys, the mode adjusting way being different from the mode presenting way.
- [0031] In Example 6, the subject matter of Example 4 may optionally include that a further corresponding indicator of the plurality indicators with which a further threshold value associated is configured to turn on in the mode presenting way, and an adjusted setup value of the mode adjusted by the controls is equal to the further threshold value associated with the further corresponding indicator.
- [0032] In Example 7, the subject matter of Example 4 may optionally include that when the mode is activated, a selected number of the plurality of analog input keys is turned on in response to releasing and actuating of the selected number of the plurality of analog input keys.
- [0033] In Example 8, the subject matter of any of Examples 2 to 7 may optionally include that the threshold values of the plurality of indicators comprises a sequence of numbers in connection with the travel distance of the plurality of analog input keys.
- [0034] In Example 9, the subject matter of Example 8 may optionally include that the sequence of numbers is preset with equal distance.
- [0035] In Example 10, the subject matter of any of Examples 4 to 9 may optionally include that a respective combination of the plurality of analog input keys are configured to activate or deactivate a respective mode of the plurality of modes of the analog input device.
- [0036] In Example 11, the subject matter of Example 10 may optionally include that the plurality of modes comprises an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode.
- [0037] In Example 12, the subject matter of any of Examples 1 to 11 may optionally include that the plurality of indicators comprise a plurality of light-emitting diode (LED) lights.
- [0038] Example 13 is a system for receiving and processing analog input, the system comprising: an input module configured to receive analog input from a plurality of analog input keys and inputs from controls configured to adjust a setup value of the plurality of analog input keys; an output module configured to output control signal to a plurality of indicators; and wherein the output module is configured to turn on the plurality of indicators to represent the setup value of the plurality of analog input keys.
- [0039] In Example 14, the subject matter of Example 13 may optionally include that a respective indicator of the plurality of indicators is associated with a respective threshold value in connection with a travel distance of the plurality of analog input keys.

- [0040] In Example 15, the subject matter of Example 14 may optionally include that the output module is configured to turn on the respective indicator of the plurality of indicators when the travel distance of the plurality of analog input keys exceeds that threshold value associated with the respective indicator.
- [0041] In Example 16, the subject matter of Example 13 may optionally include that when a mode of a plurality of modes is activated by the input module, the output module is configured to turn on in a mode presenting way a corresponding indicator of the plurality of indicators with which a threshold value associated, and a setup value of the mode is equal to the threshold value associated with the corresponding indicator.
- [0042] In Example 17, the subject matter of Example 16 may optionally include that when the mode is activated, the output module is configured to turn on in a mode adjusting way the plurality of indicators in response to the travel distance of the plurality of analog input keys, the mode adjusting way being different from the mode presenting way.
- [0043] In Example 18, the subject matter of Example 16 may optionally include that the output module is configured to turn on in the mode presenting way a further corresponding indicator of the plurality of indicators with which a further threshold value associated, and the adjusted setup value of the mode adjusted by the controls is equal to the further threshold value associated with the further corresponding indicator.
- [0044] In Example 19, the subject matter of Example 16 may optionally include that when the mode is activated, the output module is configured to turn on a selected number of the plurality of analog input keys in response to releasing and actuating of the selected number of the plurality of analog input keys.
- [0045] In Example 20, the subject matter of any of Examples 14 to 19 may optionally include that the threshold values of the plurality of indicators comprises a sequence of numbers in connection with the travel distance of the plurality of analog input keys.
- [0046] In Example 21, the subject matter of Example 20 may optionally include that the sequence of numbers is preset with equal distance.
- [0047] In Example 22, the subject matter of any of Examples 16 to 21 may optionally include that a respective combination of the plurality of analog input keys are configured to activate or deactivate a respective mode of the plurality of modes of the analog input device.
- [0048] In Example 23, the subject matter of Example 22 may optionally include that the plurality of modes comprises an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode.
- [0049] FIG. 1 shows a schematic diagram of an analog input device 100 according to various embodiments. According to various non-limiting embodiments, the analog input device 100 may include a plurality of analog input keys 110. For example, when

the analog input device 100 is a mouse, the analog input device 100 may include two or more analog click buttons. When the analog input device 100 is a keypad having 15-25 keys, the analog input device 100 may include up to 15-25 analog keys. When the analog input device 100 is a gaming controller having four or more buttons, the analog input device 100 may include two or three or four or more analog buttons. When the analog input device 100 is a keyboard, the analog input device 100 may include a plurality of analog keys.

- [0050] According to various non-limiting embodiments, the analog input device 100 may comprise controls 140 configured to adjust a setup value of the analog input keys 110. In some embodiments, the controls 140 may include arrow keys, for example, in the context of a keyboard, as well as an adjusting knob, for example, volume adjusting knob. That may mean that the controls 140 may or may not include a number of the plurality of analog input keys 110.
- [0051] According to various non-limiting embodiments, the analog input device 100 may also comprise a display 120 having a plurality of indicators 130. The plurality of indicators 130 may be configured to turn on to present the setup value of the plurality of analog input keys 110. In other words, the plurality of indicators 130 may function as a meter display, displaying the setup value of the plurality of analog input keys 110 (e.g. a global setup value of the plurality of analog input keys 110) .
- [0052] According to various non-limiting embodiments, the plurality of indicators 130 may be configured to turn on in response to a travel distance of the plurality of analog input keys 110. The plurality of analog input keys 100 may be pressed by a user to travel from a default position to a maximum position where the plurality of analog input keys 100 are blocked/stopped in accordance with a force exerted by the user. The travel distance of the plurality of analog input keys 100 may refer to a distance moved in between the default position and the maximum position and in accordance with the force exerted by the user. In other words, the travel distance may increase as the force exerted by the user increases. Further, the travel distance of the plurality of analog input keys 100 may have an up direction (travelling toward to the default position) and a down direction (travelling away from the default position) .
- [0053] According to various non-limiting embodiments, the analog input device 100 may further comprise a printed circuit board (PCB) (not shown) .
- [0054] According to various non-limiting embodiments, the plurality of analog input keys 110 may be configured to output analog data in response to the travel distance of the plurality of analog input keys 110. The plurality of analog input keys 110 may be configured to output continuous analog data when the travel distance increases continuously from zero to its maximum. In some embodiments, the analog data may be set from zero to 255. That may mean when the plurality of analog input keys 110 is

pressed to its maximum position, the analog data may be correspondingly 255, when the plurality of analog input keys 110 is released to its default position, the analog data may be correspondingly 0, and when the plurality of analog input keys 110 is partially pressed, the analog data may be correspondingly between 0 and 255. The analog data may map to the travel distance of the plurality of analog input keys 110. For example, the maximum of the travel distance (e.g. 4.0 mm) may be mapped to the analog data of 255, and the travel distance increasing continuously from zero to its maximum may be mapped to continuous analog data from zero to 255.

- [0055] According to various non-limiting embodiments, a respective indicator of the plurality of indicators 130 may be associated with a respective threshold value in connection with the travel distance of the plurality of analog input keys 110. In other words, each indicator of the plurality of indicators 130 may represent a value, i.e. its threshold value.
- [0056] In some embodiments, in an adjustment mode (e.g. a respective mode is activated), the respective indicator of the plurality of indicators 130 may be configured to turn on for preview when the travel distance of the plurality of analog input keys 110 exceeds that threshold value associated with the respective indicator. The threshold values of the plurality of indicators 130 may be preset in connection with the travel distance of the plurality of analog input keys 110.
- [0057] In some embodiments, the threshold values of the plurality of indicators 130 may include a sequence of numbers in connection with the travel distance of the plurality of analog input keys 110. The sequence of numbers may be preset with equal distance. For example, the maximum of the travel distance of the plurality of analog input keys 110 may be 4.0 mm, the number of the plurality of indicators may be 10, and accordingly, a first threshold value of a first indicator may be 0.1 mm, a second threshold value of a second indicator may be 0.4 mm, a third threshold value of a third indicator may be 0.8 mm, a fourth threshold value of a fourth indicator may be 1.2 mm, a fifth threshold value of a fifth indicator may be 1.6 mm, a sixth threshold value of a sixth indicator may be 2.0 mm, a seventh threshold value of a seventh indicator may be 2.4 mm, an eighth threshold value of an eighth indicator may be 2.8 mm, a ninth threshold value of a ninth indicator may be 3.2 mm, and a tenth threshold value of a tenth indicator may be 3.6 mm. In other words, the threshold values of the plurality of indicators 130 may include a sequence of numbers (e.g. 0.1 mm, 0.4 mm, 0.8 mm, 1.2 mm, 1.6 mm, 2.0 mm, 2.4 mm, 2.8 mm, 3.2 mm, and 3.6 mm) in connection with the travel distance (e.g. with a maximum value of 4.0 mm) of the plurality of analog input keys 110 and the sequence of numbers may be preset with equal distance (e.g. 0.4 mm except the difference between the first threshold and the second threshold and including the difference between the tenth (last) threshold and

the maximum value of the travel distance) . That may mean when the travel distance is 2.2 mm, the first to six indicators of the ten indicators may be collectively turned on. In some embodiment, when the analog input device 110 is at an adjustment mode (e.g. a respective mode is activated) , if more than one key of the plurality of analog input keys 110 are pressed, a longer/longest travel distance may be considered as the travel distance as described herein.

[0058] In other embodiments, in an adjustment mode (e.g. a respective mode is activated) , the respective indicator of the plurality of indicators 130 may not turn on when the travel distance of the plurality of analog input keys 110 exceeds that threshold value associated with the respective indicator. The plurality of analog input keys 110 may instead be configured to turn on in response to its travel distance as described herein for preview.

[0059] According to various non-limiting embodiments, the analog input device 100 may further include a storage element (not shown) . According to various non-limiting embodiments, the storage element may be a memory. According to various embodiments, the memory may include, but not limited to, a read-only memory (ROM) , an erasable programmable read-only memory (EPROM) , or a flash memory. According to various non-limiting embodiments, the threshold values of the plurality of indicators 130 may be preset (e.g. by a software of the analog input device 100) and stored in a memory in the analog input device 100, for example, in a format of a table.

[0060] According to various non-limiting embodiments, a respective combination of the plurality of analog input keys 110 may be configured to activate or deactivate a respective mode of the plurality of modes of the analog input device 100. In some embodiments, the plurality of modes may include an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode. For example, in the context of a keyboard, a combination of Fn + Tab may be used to activate or deactivate the actuation point adjustment mode of the keyboard and a combination of Fn + Caps may be used to activate or deactivate the rapid trigger sensitivity adjustment mode of the keyboard. That may mean a common key (e.g. Fn in the context of a keyboard) may be used to activate or deactivate the plurality of modes. In an example, in the context of a keyboard, Esc key may be used to deactivate the plurality of modes.

[0061] According to various non-limiting embodiments, when a mode of a plurality of modes is activated, the plurality of keys 110 may not register any input, i.e. not output analog data to a host device in communication with the analog input device 100.

[0062] According to various non-limiting embodiments, when a mode of a plurality of modes is activated, a corresponding indicator of the plurality of indicators 130 with which a threshold value associated may be configured to turn on in a mode presenting way, and a setup value of the mode is equal to the threshold value associated with

the corresponding indicator. Stated differently, a setup value may be preset (e.g. by a software) for the mode of the plurality of modes, and when the mode is activated, a corresponding indicator of the plurality of indicators 130 may be turned on, the threshold value associated with the corresponding indicator being equal to the setup value of the mode. That is, the corresponding indicator (i.e. corresponding to the mode) of the plurality indicators 130 may indicate the setup value of the mode. That may mean in the mode presenting way, one corresponding indicator of the plurality of indicators 130 may be turned on in accordance with the setup value of the mode.

[0063] In some embodiments, when the mode is activated, the plurality of indicators 130 may be further configured to turn on in a mode adjusting way in response to the travel distance of the plurality of analog input keys 110. In other words, when the mode is activated, the plurality of indicators 130 may be further configured to turn on in the mode adjusting way in response to depression of the plurality of analog input keys 110 by a user (e.g. testing the plurality of analog input keys (e.g. non-control keys of the plurality of analog input keys) by the user) . In various embodiments, the plurality of indicators 130 may be turned on in different ways, including the mode adjusting way and the mode presenting way. In the mode adjusting way, one or more indicators of the plurality of indicators 130 may be turned on in accordance with the force that the user exerted on the plurality of analog input keys 110 as described hereinbefore.

[0064] According to various non-limiting embodiments, a further corresponding indicator of the plurality indicators 130 with which a further threshold value associated may be configured to turn on in the mode presenting way, and an adjusted setup value of the mode adjusted by the controls 140 may be equal to the further threshold value associated with the further corresponding indicator. In other words, upon testing the plurality of analog input keys 110 (e.g. non-control keys of the plurality of analog input keys 110) by the user, the user may adjust the setup value of the mode to the adjusted setup value of the mode by the controls 140 (e.g. actuation +/-keys of the plurality of analog input keys 110, or a knob of the analog input device 100) , and accordingly, the corresponding indicator may be replaced by the further corresponding indicator of the plurality indicators 130, that is, the corresponding indicator may be turned off and the further corresponding indicator of the plurality indicators 130 may be turned on. The adjusted setup value of the mode may be collectively applicable to the plurality of analog input keys 110.

[0065] According to various non-limiting embodiments, actuation point may define a distance at which the key needs to depress to register as an input and reset point may define a distance at which the key needs to rebound for the key to reset. In the actuation point adjustment mode, the actuation point of the plurality of keys 110 may be adjusted, for example, by adjusting the setup value of the mode. A user may

adjust the actuation point of the plurality of keys 110 by the controls 140 of the analog input device 100 as described in more details with reference to FIG. 4. The adjusted actuation point adjusted by the analog input device 100 may overwrite the setup value loaded (e.g. previously saved in the firmware) . A pop-up may appear to confirm which setup value to keep (i.e. the setup value of the mode or the adjusted setup value of the mode) . The firmware may send a notification to an application (e.g. a software) installed in a host device in communication with the analog input device 100 via a USB. The adjusted setup value of the mode may be collectively applicable to the plurality of analog input keys 110.

[0066] According to various non-limiting embodiments, the rapid trigger may allow the plurality of keys 110 reset the instant the plurality of keys 110 travel upwards once an input is registered. That is, the actuation point is no longer fixed. For example, if a user presses a key down by 2.0 mm with a rapid trigger up sensitivity set to 0.3 mm, the firmware may remember the 2.0 mm as the peak, allowing the user to move the key freely between 1.7 mm and 2.0 mm (1.7 mm not included) without any changes and only releasing the key if the user release the key by 0.3 mm or greater starting from the peak, i.e. ≤ 1.7 mm. The same logic may apply to pressing the key down. If the user moves the key upwardly to a travel distance of 2.0 mm with a rapid trigger down sensitivity of 0.4 mm, the firmware may remember the peak of 2.0 mm, allowing the user to move the key between 2.0 mm and 2.4 mm (2.4 mm not included) . If the user presses the key back in by 2.4 mm or greater, it may start pressing it again (e.g. register a keystroke) . If the user does not push it beyond 2.4 mm and instead decide to go further up to a travel distance less than 2.0 mm, the peak may update accordingly. In the rapid trigger sensitivity adjustment mode, the rapid trigger up sensitivity and the rapid trigger down sensitivity (i.e. collectively, the rapid trigger sensitivity) of the plurality of keys 110 may be adjusted, for example, by adjusting the setup value of the mode. A user may adjust the rapid trigger sensitivity of the plurality of keys 110 by controlling the controls 140 of the analog input device 100 as described herein. Similarly, the adjusted rapid trigger sensitivity adjusted by the analog input device 100 may overwrite the setup value loaded (e.g. previously saved in the firmware) . A pop-up may appear to confirm which setup value to keep (i.e. the setup value of the mode or the adjusted setup value of the mode) . The firmware may send a notification to an application (e.g. a software) installed in a host device in communication with the analog input device 100 via a USB. The adjusted setup value of the mode may be collectively applicable to the plurality of analog input keys 110.

[0067] According to various non-limiting embodiments, the plurality of indicators 130 may turn on in the mode presenting way, or in the mode adjusting way, or in both the mode adjusting way and the mode presenting way.

- [0068] According to various non-limiting embodiments, the plurality of indicators 130 may include a plurality of light-emitting diode (LED) lights. In some embodiments, the plurality of indicators 130 may be turned on in different ways, including the mode adjusting way and the mode presenting way; in the mode adjusting way, the plurality of LED lights may be turned on in a different colour (e.g. white) from the mode presenting way (e.g. green) .
- [0069] According to various non-limiting embodiments, the analog input device 100 may include an analog-to-digital converter (ADC) (not shown) . The ADC may receive the analog data from the plurality of analog input keys 110 and may be configured to discretize the analog data into a corresponding digital-step-value. According to various embodiments, the ADC may convert the continuous-time and continuous-amplitude analog data into a discrete-time and discrete-amplitude digital-step-value. According to various embodiments, the ADC may perform the conversion at a predetermined sampling interval. According to various embodiments, the total number of discrete digital-step-values for the range of analog data may be based on a resolution of the ADC. Accordingly, each integer number of the digital-step-value may represent a corresponding magnitude of the analog data.
- [0070] According to various embodiments, the analog input device 100 may include a processor (not shown) . The processor may be coupled to a storage element of the analog input device 100 and may be configured to execute the instructions stored in the storage element. The processor may be coupled to the ADC in a manner so as to receive the digital-step-value. The processor may be configured to output a data packet including a key identity (ID) of the plurality of analog input keys 110 pressed by the user's finger and the digital-step-value corresponding to the analog data from the plurality of analog input keys 110. According to various embodiments, the processor and the ADC may be in digital communication with each other. Accordingly, the digital-step-value converted by the ADC may be digitally communicated to the processor from the ADC. According to various embodiments, the processor may receive various information data from the ADC and may arrange, compile and/or format the various information data, including key identity (ID) and the digital-step-value, into a string of formatted data for transmission.
- [0071] According to various embodiments, the ADC and the processor may be separate elements of the analog input device 100. According to various embodiments, the ADC and the processor may be integrated as a single microcontroller.
- [0072] FIG. 2 shows a schematic diagram of an analog input device 200 according to various non-limiting embodiments. According to various non-limiting embodiments, the analog input device 200 of FIG. 2 may include the features of the analog input device 100 of FIG. 1. Accordingly, the features, changes, modifications, and variations

that are applicable to the analog input device 100 of FIG. 1 may also be applicable to the analog input device 200 of FIG. 2 and vice versa.

- [0073] According to various non-limiting embodiments, the analog input device 200 of FIG. 2 may include a display 201 having a plurality of indicators 210, 220, a plurality of analog input keys (not shown) and controls (not shown). The plurality of indicators 210, 220, may be configured to turn on to represent a setup value of the plurality of analog input keys.
- [0074] According to various non-limiting embodiments, the plurality of indicators 210, 220, may include one or more subsets 210, 220, of indicators, a respective subset of indicators turned on in a respective way including the mode presenting way and/or the mode adjusting way. Stated differently, the respective subset of indicators of the plurality of indicators 210, 220, may turn on in the mode presenting way, or in the mode adjusting way, or in both the mode adjusting way and the mode presenting way. In various embodiments, the plurality of indicators 210, 220, may include a first subset 210 of indicators having a LED indicator array with 10 RGB LEDs and a second subset 220 of indicators. The first subset 210 of indicators may function as a LED meter representing a magnitude of a feature of the analog input device 200 as described herein. The second subset 220 of indicators may function as a C1SMGP indicator (C-Caps lock; 1-Num lock; S-scroll lock; M-macro recording; G-gaming mode). In some embodiments, the C1SG indicators may include white LEDs, the M indicator may include a red LED, and the P indicator may include an RGB LED representing for various profiles.
- [0075] According to various non-limiting embodiments, when a mode of a plurality of modes is activated, a corresponding indicator of the LED indicator array 210 may be configured to turn on in a mode presenting way, representing a setup value of the mode (e.g. loaded from a firmware of the analog input device 200). The mode presenting way may include that the corresponding indicator of the LED indicator array 210 is turned on in a respective colour (e.g. green). When a mode of a plurality of modes is activated, the C1SMGP indicator 220 may be turned off. According to various embodiments, the analog input device 200 of FIG. 2 may further include a lighting arrangement (not shown) including backlighting for the plurality of analog input keys, and/or underglow lighting for the analog input device 200. Accordingly, when a mode of a plurality of modes is activated, the plurality of analog input keys may show static lighting effect (e.g. corresponding green effect) in 100% brightness. For example, in the context of a keyboard, the Esc key may exceptionally show red in 100% brightness.
- [0076] In some embodiments, when a mode is activated, the LED indicator array 210 may be further configured to turn on in a mode adjusting way in response to the travel distance of the plurality of analog input keys 110 for preview. As an example, the

threshold values of the LED indicator array 210 may include a sequence of numbers, e.g. 0.1 mm, 0.4 mm, 0.8 mm, 1.2 mm, 1.6 mm, 2.0 mm, 2.4 mm, 2.8 mm, 3.2 mm, and 3.6 mm in connection with the travel distance with a maximum value of 4.0 mm of the LED indicator array 210 (e.g. in the actuation point adjustment mode). Further, the above threshold values may be sequentially associated with the first to ten LEDs from the left of the LED indicator array 210 as shown in FIG. 2. In the exemplary embodiment, a user may press the plurality of analog input keys (e.g. non-control keys of the plurality of analog input keys) in a manner that the plurality of analog input keys (e.g. non-control keys of the plurality of analog input keys) has a travel distance of 2.2 mm. Accordingly, the LEDs with the threshold values of 0.1 mm, 0.4 mm, 0.8 mm, 1.2 mm, 1.6 mm, 2.0 mm, i.e. the first to six LEDs from the left of the LED indicator array 210 may be turned on. In various embodiments, the mode adjusting way may include that the LEDs of the LED indicator array 210 may be turned on in a respective colour (e.g. white).

[0077] In other embodiments, when a mode is activated, the LED indicator array 210 may be only turned on in a mode presenting way but not turn on in a mode adjusting way in response to the travel distance of the plurality of analog input keys 110. A selected number of the plurality of analog input keys may be turned on in a lighting effect for preview. The adjustment mode may be enabled/disabled by a designated key or key combination so as to turn on/off the lighting effect of the selected number of the plurality of the analog input keys. The selected number of plurality of analog input keys may include keys with a corresponding function (e.g. rapid trigger) with a setup value (e.g. rapid trigger sensitivity) adjusted in the mode. As an example, the threshold values of the LED indicator array 210 may include a sequence of numbers, e.g. 0.1 mm, 0.2 mm, 0.3 mm, 0.4 mm, 0.5 mm, 0.6 mm, 0.7 mm, 0.8 mm, 0.9 mm, and 1.0 mm in connection with the travel distance with a maximum value of 4.0 mm of the LED indicator array 210 (e.g. in the rapid trigger sensitivity adjustment mode). Further, the above threshold values may be sequentially associated with the first to ten LEDs from the left of the LED indicator array 210 as shown in FIG. 2.

[0078] In the exemplary embodiment, if the rapid trigger sensitivity is 0.2 mm, the selected number of the plurality of analog input keys may be pressed in a manner that the selected number of the plurality of analog input keys has an actuation/releasing distance ≥ 0.2 mm (i.e. exceeding the rapid trigger sensitivity) to register a further input or lease the key, after an initial input is registered. The actuation/releasing distance may be defined as a distance from a registered position where the plurality of analog input keys pass an actuation point and register the initial input (e.g. an initial travel distance of the plurality of analog input keys). Accordingly, the lighting effect of the selected number of the plurality of analog input keys may be in a respective

colour (e.g. green or red) . In the exemplary embodiment, if the actuation distance is 0.3 mm, referring a down direction (i.e. actuating, away from the registered position of the plurality of analog input keys) , the lighting effect of the selected number of the plurality of analog input keys may be in a first colour (e.g. green) indicating a new input may be registered; if the releasing distance is 0.3 mm, referring an up direction (i.e. releasing, from the registered position and moving toward the default position of the plurality of analog input keys) , the lighting effect of the selected number of the plurality of analog input keys may be in a second colour (e.g. red) indicating the key may be released.

[0079] According to various non-limiting embodiments, a further corresponding indicator (e.g. a further corresponding LED) of the LED indicator array 210 may be configured to turn on in the mode presenting way, and an adjusted setup value of the mode adjusted by the controls may be equal to a further threshold value associated with the further corresponding indicator.

[0080] FIG. 3 shows a schematic diagram of an analog keyboard 300 as an example of the analog input device 100, 200 according to various non-limiting embodiments.

[0081] According to various non-limiting embodiments, the analog keyboard 300 of FIG. 3 may include a display 301 having a plurality of indicators, a plurality of analog input keys 310 and controls (e.g. 314, 340) , configured to adjust a setup value of the plurality of the analog input keys 310. The display 301 of the analog input device 300 may be similar to the display 201 of the analogy input device 200. The plurality of indicators of the display 301 may be configured to turn on to represent a setup value of the plurality of analog input keys 310. The analog keyboard 300 shall not be limited to the configuration as shown in FIG. 3, for example, the position and orientation of the display 301, the controls (e.g. 314, 340) may vary.

[0082] According to various non-limiting embodiments, the analog keyboard 300 may include a plurality of analog switches (or analog pressure sensor) each disposed under the plurality of analog input keys, a microcontroller that includes a processor and a memory, and an analog-to-digital converter (ADC) . The analog switches may be based on opto-mechanical switch technology and output different analog signals according to the pressure or force applied to the plurality of analog input keys or the travel distance (e.g. displacement) of the plurality of analog input keys compared with the un-pressed position. The ADC may convert the analog output into digital signals and send the digital signals to the microcontroller to preprocess the data.

[0083] The analog keyboard 300 may be connected with a host computer wirelessly or through a USB. The host computer may receive the preprocessed data from the microcontroller and perform calculation to determine the pressure or force applied to one or more keys and proceed with actions to be taken by a host processor (not shown)

of the host computer. According to various embodiments, a host processor of the host computer may proceed with a particular action (e.g. a character moving at a certain magnitude of speed which corresponds to a certain amount of depression of the key) .

- [0084] Firmware may be held in the memory (or storage element) such as ROM, EPROM, or flash memory, in order to provide control for the switches and translate the analog signals sent from each analog switch to the hosting computer, such that the hosting computer may further process the signals or data to realize the corresponding functions.
- [0085] In one example embodiment, when the user presses a key (or a button assembly) to a travel distance, the firmware may register this event and the event will be read by the microcontroller. Different events may be registered for different travel distances the keys are pressed down. This microcontroller may constantly be monitoring the keys on the keypad via scanning, which may occur many times per second. The firmware may register when the key is pressed and to what distance the key is pressed, and rapidly perform the process of translating the keypresses from physical contact into electrical signals and then outputting them to the host computer for proportionally (e.g. linearly) controlling a corresponding predetermined application event.
- [0086] The above-mentioned analog keyboard 300 is shown as one example embodiment of an analog input device. Other input devices such as mice, keypads or controller with analog switches also apply. One or more features of the input device other than computer games may advantageously be incorporated for many other applications in translating user intent to a form interpretable by any type of computing device, including, but not limited to, personal computers, entertainment systems, industrial computing systems, stenography devices, medical computing systems, and other computing devices.
- [0087] According to various non-limiting embodiments, the controls of the analog input device 300 may further include a knob 340 and/or arrow keys 314. The arrow keys 314 may be part of the analog input keys 310. Accordingly, non-control keys may refer to analog input keys other than the arrow keys 314 of the analog input keys 310. The knob 340 and the arrow keys 314 of the analog input device 300 may be defined as actuation +/-keys of the plurality of analog input device 300. Accordingly, a user may use the knob 340 and the arrow keys 314 of the analog input device 300 to adjust the setup value of the mode when the mode is activated so as to determine an adjusted setup value of the mode. In other words, the knob 340 and the arrow keys 314 of the analog input device 300 may be used by the user to adjust the corresponding indicator of the mode to the further corresponding indicator of the mode.
- [0088] FIG. 4 shows a schematic diagram of the display 310 of the analog input device 300 in an adjustment mode of the plurality of modes (e.g. adjustment of the setup

value of the actuation point adjustment mode) according to various non-limiting embodiments. When the adjustment mode is activated, the corresponding indicator 331 of the plurality of indicators as denoted as 330a in FIG. 4 is turned on in the mode presenting way (e.g. in dark grey) . A user may test the plurality of analog input keys by pressing the plurality of analog input keys (e.g. non-control keys of the plurality of analog input keys) for preview. Accordingly, the plurality of indicators may be turned on in the mode adjusting way (e.g. five LEDs turned on in white) as denoted as 330b in FIG. 4. The user may adjust the setup value of the mode by the knob 340 (e.g. clockwise or counter-clockwise) and the arrow keys 314 of the analog input device 300. In some embodiments, one depression of any of the arrow keys 314 may move the corresponding indicator 331 to a neighboring LED (an immediate left or right LED to the corresponding indicator 331) and consequently the setup value of the mode is adjusted by one level. In the exemplary embodiments as described herein, the threshold values of the LED indicator array may include a sequence of numbers, e.g. 0.1 mm, 0.4 mm, 0.8 mm, 1.2 mm, 1.6 mm, 2.0 mm, 2.4 mm, 2.8 mm, 3.2 mm, and 3.6 mm in connection with the travel distance with a maximum value of 4.0 mm of the LED indicator array 210. A depression on the Up arrow of the arrow keys 314 may move the corresponding indicator 331 to one upper level to the right, e.g. the corresponding indicator 331 having the threshold value of 2.8 mm, one upper level to the right having the threshold value of 3.2 mm.

[0089] Referring back to FIG. 3, in other embodiments, when a respective mode is activated (e.g. in the rapid trigger sensitivity adjustment mode) , the corresponding indicator of the plurality of indicators is turned on in the mode presenting way (e.g. in orange) . A user may test the plurality of analog input keys 310 by pressing the plurality of analog input keys 310 (e.g. non-control keys of the plurality of analog input keys 310) . In some embodiments, a selected number of the plurality of analog input keys 310 may be designated as testing keys for testing setup values in the respective mode for preview. For example, the “w” , “a” , “s” and “d” keys may be designated in a manner that a lighting effect of these four keys may be turned on in the adjustment mode, including a backlighting, underglow lighting or LED lighting embedded in the four selected keys. Accordingly, the use may press the selected testing keys to sense the sensitivity (e.g. up and/or down) in the respective mode. The lighting effect of the selected testing keys may be turned on in different colours for releasing (e.g. in red) and actuating (e.g. in green) . In these embodiments, the plurality of indicators may not be turned on in the mode adjusting way but only in the mode presenting way. The user may also adjust the setup value of the mode by the knob 340 and the arrow keys 314 of the analog input device 300.

- [0090] FIG. 5 shows a schematic diagram of a system 500 for receiving and processing analog input according to various embodiments. The system 500 may include at least one memory 502 and at least one processor 504 communicatively coupled to the at least one memory 502.
- [0091] It will be appreciated by a person skilled in the art that the at least one processor 504 may be configured to perform various functions or operations through set (s) of instructions (e.g., software modules) executable by the at least one processor 504 to perform various functions or operations. Accordingly, as shown in FIG. 5, the system 500 may include: an input module (or an input circuit) 512 configured to receive analog input from a plurality of analog input keys and inputs from controls configured to adjust a setup value of the plurality of analog input keys, and an output module (or an output circuit) 514 configured to output control signal to a plurality of indicators. The output module may be configured to turn on the plurality of indicators to represent the setup value of the plurality of analog input keys.
- [0092] According to various non-limiting embodiments, the input module may be configured to determine a travel distance of the plurality of analog input keys based on a digital-step-value corresponding to the analog input received from the plurality of analog input keys. The digital-step-value may be set from zero to its maximum (e.g. 255) in accordance with the travel distance from zero to its maximum.
- [0093] According to various non-limiting embodiments, a respective indicator of the plurality of indicators may be associated with a respective threshold value in connection with the travel distance of the plurality of analog input keys.
- [0094] According to various non-limiting embodiments, the output module is configured to turn on the respective indicator of the plurality of indicators when the travel distance of the plurality of analog input keys exceeds that threshold value associated with the respective indicator.
- [0095] According to various non-limiting embodiments, when a mode of a plurality of modes is activated by the input module, the output module may be configured to turn on in a mode presenting way a corresponding indicator of the plurality of indicators with which a threshold value associated, and a setup value of the mode is equal to the threshold value associated with the corresponding indicator.
- [0096] According to various non-limiting embodiments, when the mode is activated, the output module may be configured to turn on in a mode adjusting way the plurality of indicators in response to the travel distance of the plurality of analog input keys, the mode adjusting way being different from the mode presenting way.
- [0097] According to various non-limiting embodiments, the output module may be configured to turn on in the mode presenting way a further corresponding indicator of the plurality indicators with which a further threshold value associated, and the

adjusted setup value of the mode adjusted by the controls is equal to the further threshold value associated with the further corresponding indicator.

- [0098] According to various non-limiting embodiments, when the mode is activated, the output module may be configured to turn on a selected number of the plurality of analog input keys in response to releasing and actuating of the selected number of the plurality of analog input keys.
- [0099] According to various non-limiting embodiments, the threshold values of the plurality of indicators may include a sequence of numbers in connection with the travel distance of the plurality of analog input keys.
- [0100] According to various non-limiting embodiments, the sequence of numbers may be preset with equal distance.
- [0101] According to various non-limiting embodiments, a respective combination of the plurality of analog input keys may be configured to activate or deactivate a respective mode of the plurality of modes of the analog input device.
- [0102] According to various non-limiting embodiments, the plurality of modes may include an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode.
- [0103] It will be appreciated by a person skilled in the art that various modules of a system are not necessarily separate modules, and two or more modules may be realized by or implemented as one functional module (e.g., a circuit or a software program) as desired or as appropriate without deviating from the scope of the present disclosure. For example, two or more modules of the system 500 for receiving and processing analog input (e.g., the input module 512, and the output module 514) may be realized (e.g., compiled together) as one executable software program (e.g., software application or simply referred to as an “app”), which for example may be stored in the at least one memory 502 and executable by the at least one processor 504 to perform various functions/operations as described herein according to various embodiments of the present disclosure.
- [0104] It will be appreciated by a person skilled in the art that a system may include further modules, for example, the system 500 may include a data conversion module (not shown) configured to convert the analog data into digital signal as described therein.
- [0105] In various embodiments, the system 500 for receiving and processing analog input may correspond to the analog input device 100 as described hereinbefore with reference to FIG. 1 according to various embodiments, therefore, various functions or operations configured to be performed by the least one processor 504 may correspond to various functions or operations performed by the analog input device 100 as described hereinbefore according to various embodiments, and thus need not be repeated with respect to the system 500 for receiving and processing analog input for clarity and conciseness. In other words, various embodiments described herein in

context of the devices are analogously valid for the corresponding systems, and vice versa.

- [0106] In various embodiments, the system 500 may be realized by any computer system including at least one processor and at least one memory. Various functional modules may be implemented as software (firmware) , such as a computer program being executed within the system 500, and instructing the system 500 (in particular, one or more processors therein) to conduct various functions or operations as described herein according to various embodiments.
- [0107] A computing system, a microcontroller or any other system providing a processing capability may be provided according to various embodiments in the present disclosure. Such a system may be taken to include one or more processors and one or more computer-readable storage mediums. For example, the system 500 for receiving and processing analog input described hereinbefore may include at least one processor (or controller) 504 and at least one computer-readable storage medium (or memory) 502 which are for example used in various processing carried out therein as described herein. A memory or computer-readable storage medium used in various embodiments may be a volatile memory, for example a DRAM (Dynamic Random Access Memory) or a non-volatile memory, for example a PROM (Programmable Read Only Memory) , an EPROM (Erasable PROM) , EEPROM (Electrically Erasable PROM) , or a flash memory, e.g., a floating gate memory, a charge trapping memory, an MRAM (Magnetoresistive Random Access Memory) or a PCRAM (Phase Change Random Access Memory) .
- [0108] In various embodiments, a “circuit” may be understood as any kind of a logic implementing entity, which may be special purpose circuitry or a processor executing software stored in a memory, firmware, or any combination thereof. Thus, in an embodiment, a “circuit” may be a hard-wired logic circuit or a programmable logic circuit such as a programmable processor, e.g., a microprocessor (e.g., a Complex Instruction Set Computer (CISC) processor or a Reduced Instruction Set Computer (RISC) processor) . A “circuit” may also be a processor executing software, e.g., any kind of computer program, e.g., a computer program using a virtual machine code, e.g., Java. Any other kind of implementation of the respective functions may also be understood as a “circuit” in accordance with various embodiments. Similarly, a “module” may be a portion of a system according to various embodiments and may encompass a “circuit” as described above, or may be understood to be any kind of a logic-implementing entity.
- [0109] The present disclosure also discloses various systems (e.g., each may also be embodied as a device or an apparatus) , such as the system 500 for receiving and processing analog input, for performing various operations/functions performed by

various devices described herein. Such systems may be specially constructed for the required purposes, or may comprise a general-purpose computer or other device selectively activated or reconfigured by a computer program stored in the computer. The algorithms presented herein are not inherently related to any particular computer or other apparatus. Various general-purpose machines may be used with computer programs in accordance with the teachings herein. Alternatively, the construction of more specialized apparatus to perform various method steps may be appropriate.

[0110] In addition, the present disclosure also at least implicitly discloses a computer program or software/functional module, in that it would be apparent to the person skilled in the art that individual steps of various methods described herein may be put into effect by computer code. The computer program is not intended to be limited to any particular programming language and implementation thereof. It will be appreciated that a variety of programming languages and coding thereof may be used to implement the teachings of the disclosure contained herein. Moreover, the computer program is not intended to be limited to any particular control flow. There are many other variants of the computer program, which can use different control flows without departing from the scope of the disclosure. It will be appreciated by a person skilled in the art that various modules described herein (e.g., the input module 512 and the output module 514 of system 500) may be software module (s) realized by computer program (s) or set (s) of instructions executable by a computer processor to perform the required functions, or may be hardware module (s) being functional hardware unit (s) designed to perform the required functions. It will also be appreciated that a combination of hardware and software modules may be implemented.

[0111] Furthermore, two or more of the steps of a computer program/module or method described herein may be performed in parallel rather than sequentially. Such a computer program may be stored on any computer readable medium. The computer readable medium may include storage devices such as magnetic or optical disks, memory chips, or other storage devices suitable for interfacing with a computer. The computer program when loaded and executed on such the computer effectively results in a system or an apparatus that implements various steps of methods described herein.

[0112] FIG. 6 shows a flow chart 600 depicting adjustment steps in an actuation point adjustment mode of an analog keyboard according to various embodiments.

[0113] At step 602, check if the keyboard is working in a normal mode (e.g. not in an adjustment mode) . If yes, proceed to step 604; if no, that is the keyboard is in an adjustment mode, proceed to step 606.

[0114] At step 604, check if the mode trigger keys (e.g. a combination of keys) of the keyboard are pressed. If yes, proceed to step 606; if no, proceed back to step 602.

- [0115] At step 606, upon pressing the mode trigger keys to activate the actuation point adjustment mode, a corresponding indicator (e.g. a corresponding LED in a LED meter) is lighted (e.g. in green) in the mode presenting way, a threshold value of the corresponding indicator is equal to a setup value of an actuation point of a plurality of analog input keys of the keyboard.
- [0116] At step 608, check if mode exit keys (e.g. Esc key or the same combination of keys for activating the mode) are pressed. If yes, proceed to step 620; if no, proceed to step 610.
- [0117] At step 620, save all the changes (e.g. save an adjusted setup value of the actuation point of the plurality of analogy input keys of the keyboard) and notify the software (firmware) which uses the actuation point as a parameter or variable.
- [0118] At step 610, check if actuation +/-keys (i.e. controls configured to adjust the setup value of the actuation point) are presses. If yes, proceed to step 614; if no, proceed to step 612.
- [0119] At step 614, adjust actuation point by the actuation +/-keys (i.e. controls configured to adjust the setup value of the actuation point) . The corresponding indicator (e.g. the green LED) is changed to a further corresponding indicator to represent the adjusted setup value of the actuation point. That may mean the green light may move in the LED meter in response to the actuation +/-keys (i.e. controls configured to adjust the setup value of the actuation point) . Proceed to step 608.
- [0120] At step 612, check if non-control keys are pressed. If yes, proceed to step 616; if no, proceed to step 608.
- [0121] At step 616, the plurality of indicators (e.g. the LED of the LED array) of the keyboard are turned on (e.g. in white) in the mode adjusting way in response a travel distance of the plurality of the analog input keys (e.g. how deep the key is pressed) . Proceed to step 608.
- [0122] FIG. 7 shows a flow chart depicting adjustment steps in a rapid trigger sensitivity adjustment mode of an analog keyboard according to various embodiments.
- [0123] At step 702, check if the keyboard is working in a normal mode (e.g. not in an adjustment mode) . If yes, proceed to step 704; if no, that is the keyboard is in an adjustment mode, proceed to step 706.
- [0124] At step 704, check if the mode trigger keys (e.g. a combination of keys) of the keyboard are pressed. If yes, proceed to step 706; if no, proceed back to step 702.
- [0125] At step 706, upon pressing the mode trigger keys to activate the rapid trigger sensitivity adjustment mode, a corresponding indicator (e.g. a corresponding LED in a LED meter) is lighted (e.g. in orange) , a threshold value of the corresponding indicator is equal to a setup value of rapid trigger sensitivity of a plurality of analog input keys of the keyboard. A selected number of the plurality of analog input keys is

lighted on. The selected number of the plurality of analog input keys may be the keys with rapid trigger function.

- [0126] At step 708, check if mode exit keys (e.g. Esc key or the same combination of keys for activating the mode) are pressed. If yes, proceed to step 722; if no, proceed to step 710.
- [0127] At step 722, save all the changes (e.g. save an adjusted setup value of the rapid trigger sensitivity of the plurality of analogy input keys of the keyboard) and notify the software (firmware) which uses the rapid trigger sensitivity as a parameter or variable.
- [0128] At step 710, check if sensitivity +/-keys (i.e. controls configured to adjust the setup value of the rapid trigger sensitivity) are presses. If yes, proceed to step 714; if no, proceed to step 712.
- [0129] At step 714, adjust the setup value of the rapid trigger sensitivity by the sensitivity +/-keys (i.e. controls configured to adjust the setup value of the rapid trigger sensitivity) . The corresponding indicator (e.g. the orange LED) is changed to a further corresponding indicator to represent the adjusted setup value of the rapid trigger sensitivity. That may mean the orange light may move in the LED meter in response to the sensitivity +/-keys (i.e. controls configured to adjust the setup value of the rapid trigger sensitivity) . Proceed to step 708.
- [0130] At step 712, check if enable key is pressed to enable the rapid trigger. If yes, proceed to step 718; if no, proceed to step 716.
- [0131] At step 716, check if non-control keys are pressed. If yes, proceed to step 720; if no, proceed to step 708.
- [0132] At step 718, toggle rapid trigger enable/disable setting for every adjustment. Proceed to step 708.
- [0133] At step 720, the selected number of plurality of analog input keys of the keyboard is turned on in green actuating of the plurality of the analog input keys and in red for releasing of the plurality of analog input keys. Proceed to step 708.
- [0134] While the invention has been particularly shown and described with reference to specific embodiments, it should be understood by those skilled in the art that various changes, modification, variation in form and detail may be made therein without departing from the scope of the invention as defined by the appended claims. The scope of the invention is thus indicated by the appended claims and all changes which come within the meaning and range of equivalency of the claims are therefore intended to be embraced.

Claims

- [Claim 1] An analog input device comprising:
a plurality of analog input keys;
a display having a plurality of indicators; and
controls configured to adjust a setup value of the analog input keys,
wherein the plurality of indicators are configured to turn on to represent
the setup value of the plurality of analog input keys.
- [Claim 2] The analog input device of claim 1, wherein a respective indicator of
the plurality of indicators is associated with a respective threshold value
in connection with a travel distance of the plurality of analog input
keys.
- [Claim 3] The analog input device of claim 2, wherein the respective indicator
of the plurality of indicators is configured to turn on when the travel
distance of the plurality of analog input keys exceeds that threshold
value associated with the respective indicator.
- [Claim 4] The analog input device of claim 1, wherein when a mode of a plurality
of modes is activated, a corresponding indicator of the plurality of
indicators with which a threshold value associated is configured to turn
on in a mode presenting way, and a setup value of the mode is equal to
the threshold value associated with the corresponding indicator.
- [Claim 5] The analog input device of claim 4, wherein when the mode is
activated, the plurality of indicators are further configured to turn on in
a mode adjusting way in response to a travel distance of the plurality
of analog input keys, the mode adjusting way being different from the
mode presenting way.
- [Claim 6] The analog input device of claim 4, wherein a further corresponding
indicator of the plurality indicators with which a further threshold value
associated is configured to turn on in the mode presenting way, and an
adjusted setup value of the mode adjusted by the controls is equal to
the further threshold value associated with the further corresponding
indicator.
- [Claim 7] The analog input device of claim 4, wherein when the mode is
activated, a selected number of the plurality of analog input keys is
turned on in response to releasing and actuating of the selected number
of the plurality of analog input keys.

- [Claim 8] The analog input device of any of claims 2 to 7, wherein the threshold values of the plurality of indicators comprises a sequence of numbers in connection with the travel distance of the plurality of analog input keys.
- [Claim 9] The analog input device of claim 8, wherein the sequence of numbers is preset with equal distance.
- [Claim 10] The analog input device of any of claims 4 to 9, wherein a respective combination of the plurality of analog input keys are configured to activate or deactivate a respective mode of the plurality of modes of the analog input device.
- [Claim 11] The analog input device of claim 10, wherein the plurality of modes comprises an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode.
- [Claim 12] The analog input device of any of claims 1 to 11, wherein the plurality of indicators comprise a plurality of light-emitting diode (LED) lights.
- [Claim 13] A system for receiving and processing analog input, the system comprising:
an input module configured to receive analog input from a plurality of analog input keys and inputs from controls configured to adjust a setup value of the plurality of analog input keys;
an output module configured to output control signal to a plurality of indicators; and
wherein the output module is configured to turn on the plurality of indicators to represent the setup value of the plurality of analog input keys.
- [Claim 14] The system of claim 13, wherein a respective indicator of the plurality of indicators is associated with a respective threshold value in connection with a travel distance of the plurality of analog input keys.
- [Claim 15] The system of claim 14, wherein the output module is configured to turn on the respective indicator of the plurality of indicators when the travel distance of the plurality of analog input keys exceeds that threshold value associated with the respective indicator.
- [Claim 16] The system of claim 13, wherein when a mode of a plurality of modes is activated by the input module, the output module is configured to turn on in a mode presenting way a corresponding indicator of the plurality of indicators with which a threshold value associated, and a setup value of the mode is equal to the threshold value associated with the corresponding indicator.

- [Claim 17] The system of claim 16, wherein when the mode is activated, the output module is configured to turn on in a mode adjusting way the plurality of indicators in response to the travel distance of the plurality of analog input keys, the mode adjusting way being different from the mode presenting way.
- [Claim 18] The system of claim 16, wherein the output module is configured to turn on in the mode presenting way a further corresponding indicator of the plurality indicators with which a further threshold value associated, and the adjusted setup value of the mode adjusted by the controls is equal to the further threshold value associated with the further corresponding indicator.
- [Claim 19] The system of claim 16, wherein when the mode is activated, the output module is configured to turn on a selected number of the plurality of analog input keys in response to releasing and actuating of the selected number of the plurality of analog input keys.
- [Claim 20] The system of any of claims 14 to 19, wherein the threshold values of the plurality of indicators comprises a sequence of numbers in connection with the travel distance of the plurality of analog input keys.
- [Claim 21] The system of claim 20, wherein the sequence of numbers is preset with equal distance.
- [Claim 22] The system of any of claims 16 to 21, wherein a respective combination of the plurality of analog input keys are configured to activate or deactivate a respective mode of the plurality of modes of the analog input device.
- [Claim 23] The system of claim 22, wherein the plurality of modes comprises an actuation point adjustment mode and a rapid trigger sensitivity adjustment mode.