# Pegasus: A Multi-Effect Audio Processor

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*Abstract* — **As sound technology has become more affordable and accessible, music production has shifted from multi-million-dollar studios to bedrooms. This trend in the industry has sparked a demand for quality, budget-friendly equipment tailored to home producers and local artists. To this end, we present Pegasus, a multi-effect audio tool designed to deliver a multitude of quality effects at a mid-tier price point. Pegasus combines digital and analog effects to provide the best of both worlds in a streamlined, user-friendly interface. The design approach of Pegasus was geared towards cost-effectiveness, robustness and efficiency. We hope to bridge the gap between high-end audio equipment and cheap, entry-level gear to satisfy talented musicians and producers on the rise while still providing high-quality sounds. This paper details the design process of Pegasus from development to testing, where we aim to drive the future of music production with a high-quality, affordable product.**

*Index Terms* — **Musical instrument digital interfaces, Audio Systems, Pitch control (audio), Audio user interfaces, Digital signal processors**

## I. Introduction

The music production and audio equipment industries have been radically changed as technology becomes increasingly affordable and accessible. This has resulted in a shift in where music is made and how it is heard. The music makers have moved from multi-million-dollar studios to bedrooms and basements. The music listeners are going to more live concerts than ever ranging in size from stadiums to small bars and clubs. These changes in the market have left audio consumers with a higher need for products in the entry-level to mid-range categories. To this end, we present Pegasus, a multi-effect audio device designed for the bedroom producer or local artist that is looking for a high-quality, affordable multi-effect audio device with a lot of functionality.

Pegasus was designed to provide digital and analog based effects to maximize efficiency, affordability and functionality. The analog effects include an amplifier module, or a 'boost' effect as it is known in the industry, and a clipping module, otherwise known as an 'overdrive' effect. The digital effects are implemented using a dedicated integrated circuit that includes 8 options: Chorus-reverb, Flange-reverb, Tremolo-reverb, Pitch shift, Pitch-echo, Through, Reverb 1, Reverb 2. The device also features an input/output interface that is dynamic and versatile with XLR and quarter-inch TS jacks available. Also, Pegasus' simple, intuitive user-interface design intends to provide the user with effective control over many options while still being cost-effective.

Pegasus was developed with the extensive and diverse background qualifications of the team to deploy various design methods and techniques that ensured a sound technical product that is user friendly. The outcome of this work has produced a cost-effective, high-quality, multi-effect audio device that is reliable and easy to use. The realization of Pegasus has helped to bridge the gap between entry-level and professional-grade audio devices, finally giving many musicians a chance to create interesting, high-quality tones at an affordable price.

## II. System Overview

A user of the Pegasus multi-effect audio device will be able to input a balanced line-level or an unbalanced mic-level signal via an XLR-TRS combination connector. Using a footswitch on the device, the user can toggle the various analog and digital effects on the device. As mentioned previously, the analog effects include a variable signal boost and a distortion/overdrive. The eight available digital effects are selected using a rotary encoder knob on the user interface. There are also various potentiometers that allow the user to manipulate the different effects modules to allow for fine-tuning of the effect chain. A small LCD display will show which effects are currently active in the signal chain as well as which digital effect is currently selected. The user will then input an audio signal from their instrument or device which will travel through the appropriate circuitry, coloring the sound with the engaged effects along the way.

Upon reaching the output interface of the device, the audio signal can be sent to a speaker or another effects device using an XLR-TRS combination connector. Pegasus is powered by a standard 9V input ensuring compatibility with onboard components, as well as with most pedalboard power supplies.

Pegasus is delivered in a relatively compact package that is ready for a musician to plug in and use. The user interface is intuitively designed with sturdy and tactile controls that allow the user to easily integrate the device into their current setup. In Fig. 1, a high-level system block diagram shows the various modules and interconnections of Pegasus.

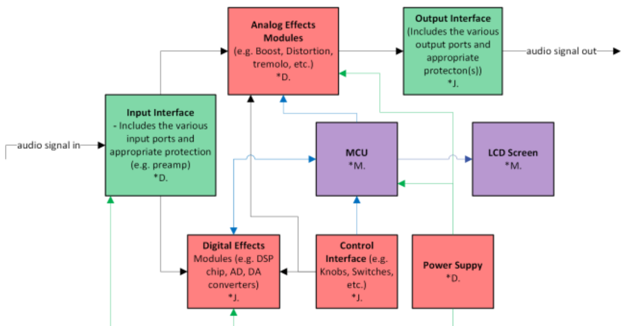


Fig. 1. System Overview Block Diagram

## III. Hardware Design

In this section, the hardware design of Pegasus is outlined in more detail, including why we chose certain components. Overall, the hardware design approach for Pegasus was one that championed efficiency, cost and user-friendliness. The hardware components of Pegasus can be divided into five subsections: User Interface, Input/Output Interface, Boost Effect, Overdrive Effect, Digital effects. In the following sections of this paper, each of these hardware sub-systems are described further along with how they fit into the larger design. See Fig. 2 for a look at how the hardware sub-systems are configured.

### *A. User Interface*

The user interface subsection facilitates all of the interactions a user would have while operating the Pegasus device. This includes toggling effects, selecting a digital effect, changing the selected effect's settings and viewing which effects are currently engaged.

The different effects modules are toggled on and off by way of a footswitch. The footswitch itself is relatively standard on an audio effects device like Pegasus, and the ones we chose to use are typical. Each footswitch is connected directly to their respective effect module in the circuit and will open or close the circuit so that the effect is added or removed to the effects chain respectively. When the switch is in the off position, the associated effects module is bypassed. When the switch is in the on position, of course the effect's circuit is engaged, and the audio signal passes through it. When an effect is engaged with the footswitch, and LED is also engaged to indicate to the user that the effect is on. Also attached to each footswitch is an optocoupler in between the sense output for each module. The sense output is sent to the microcontroller to allow the effect's toggle position to be shown on the LCD screen. The optocoupler is used to protect the circuit from any unwanted noise.

A 1602 I2C LCD screen is used to display the currently engaged effects modules along with which digital effect is currently selected. This screen was chosen for its availability, cost-effectiveness and integrability in Pegasus' design. The screen receives power from the five-volt regulator in the power distribution circuitry and a decoupling capacitor is used for protection and noise-filtering.

The LCD screen is connected and driven by an ATMEGA328P-PU microcontroller. This specific microcontroller was chosen because it met the input/output requirements for Pegasus along with being highly reprogrammable with an Arduino platform. The microcontroller receives the sense outputs from the footswitch circuitry and processes these signals to display the current effect chain. Three digital signals are also sent to the microcontroller from the rotary encoder which are processed and used to display which digital effect is selected. Lastly, a 16 MHz crystal is connected to the MCU control the LCD screen. This crystal is connected to load capacitors for stabilization.

### *B. Input/Output Interface*

The Input/Output Interface is where the various signals enter and exit the Pegasus device. This includes both the audio input jack and audio output jack as well as the power for the device.

The audio input and output of Pegasus is facilitated by an XLR/quarter-inch combo jack that is commonly found on audio devices across the industry. If the user is using an XLR connector, the input is fed to a circuit that will take this balanced signal and unbalance it. XLR signals are balanced to reduce noise and interference. The XLR cable carries two copies of the audio signal, one that is inverted. Any noise that is picked up in the cable is cancelled out when the inverted signal is flipped and combined with the other signal. Thus, we have included a differential amplifier circuit to perform this operation and send the clean signal to the rest of the circuit. If the user is using the quarter-inch TS input, the signal is fed to an input buffer. This input buffer is used for impedance matching and circuit protection purposes. These signals are fed to a toggle switch that selects the correct input to be sent to the rest of the circuit.

After being processed by the selected effects chain in Pegasus, the signal is sent to the output jack. The output signal is split and simultaneously sent directly to the TS quarter-inch output and the XLR output circuit. The XLR output circuit uses a non-inverting buffer and an inverting amplifier to rebalance the output signal to be used with the XLR connector.

Pegasus requires a twelve-volt power supply, which is supplied through a common DC power jack. The ground pin on this jack is split into three ground planes, one for analog and two for digital. The 12V input is connected to 9V, 5V and 3.3V regulators that are used to provide the appropriate power to the rest of the circuit.

### *C. Boost Effect*

The Boost Effect section of Pegasus is one of the two analog effects on board the device. This effect amplifies the audio signal while also providing some slight coloration to the signal in the form of distortion. The distortions happen at the higher end of the amplification spectrum due to clipping in the circuit. The boost effect is driven by an operational amplifier in a non-inverting amplifier circuit configuration. The op-amp was chosen for this circuit as opposed to a FET or BJT because the op-amp provided the most headroom before clipping and a high impedance input. At the input a pull-down resistor, a pull-up resistor and a coupling capacitor reduce unwanted noise and provide protection. The output of the op-amp is connected to the inverting input to provide the feedback loop for this circuit. There is a potentiometer connected here that allows the user to control the gain of the amplifier. Also, in the feedback loop there are two diodes in opposite directions to provide some soft, symmetrical clipping that results in a smooth, natural feeling distortion sound from the boost module. The output of this subsystem includes another coupling capacitor for protection and noise control. Overall, the boost section is designed to provide a relatively clean amplification of the audio signal that doesn't distort the sound too much.

### *D. Overdrive Effect*

The second analog effect on Pegasus is the Overdrive effect which provides a warm, gritty sound as a result of clipping in the circuit. This effect module is driven by a two-stage operational amplifier circuit where the op-amps are in a non-inverting amplifier configuration. There are coupling capacitors at input and output as well as pull-up and pull-down resistors at the input to protect the circuit from unwanted noise. In the feedback loop of the first stage of this overdrive circuit, there is a low-pass and high-pass filter to create a frequency-shaped gain response that emphasizes the high and mid sections of the signal while rolling off some of the low end to give the distortion a warm, bright feel. There is also a potentiometer that controls the gain of this section connected here. Between the two stages of this overdrive circuit there is a set Schottky diodes that provide some soft clipping before the next stage of the circuit. These diodes help to provide a smooth, natural sounding overdrive. The next op-amp stage of the overdrive circuit is set up similarly to the first one to provide a frequency-shaped gain response that further distorts the signal to provide some more depth to the sound. At the output of this effect module there are two more potentiometers that control the tone and volume of the circuit.

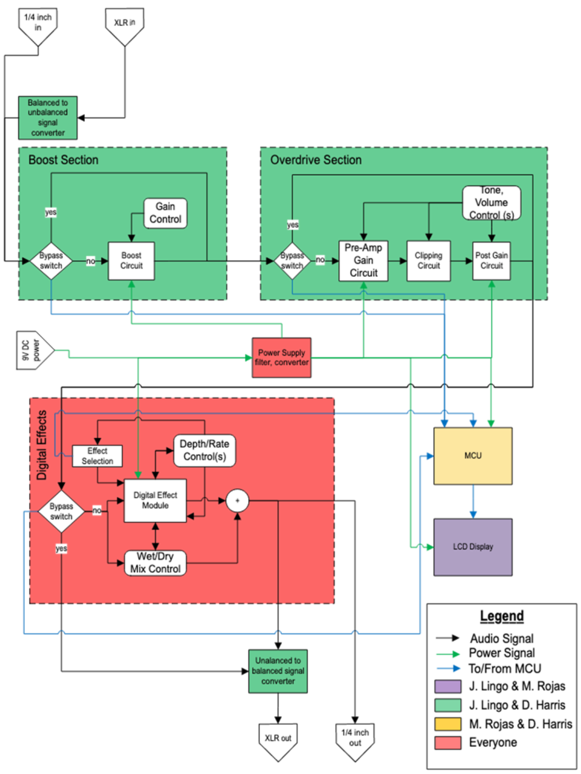


Fig. 2. Hardware Block Diagram

### *E. Digital Effects*

Digital effects on Pegasus are made possible by the use of a Spin Semiconductor FV-1 chip. The FV-1 is a dedicated digital signal processing IC that is a common solution in the audio device industry to include some nice digital reverb effects on a device. The FV-1 has eight DSP programs available for a user to select from on its ROM: Chorus-reverb, Flange-reverb, Tremolo-reverb, Pitch shift, Pitch-echo, Through, Reverb 1, Reverb 2. These eight effects can be manipulated by the user via potentiometers connected to the FV-1 via the onboard potentiometer interface. The clock on the FV-1 is driven by a standard 32768 Hz watch crystal that is connected externally. The input and output of the FV-1 are fed through an op-amp unity buffer circuit. This is to protect the signal integrity, match the impedance and isolate the FV-1 from the rest of the circuit, ensuring that the signal processed by the FV-1 is of the highest quality. The FV-1 is also connected to a three-bit rotary encoder switch that allows the user to switch between the eight different digital effects. We chose the FV-1 chip over other, similar solutions because of its robustness and integrability in Pegasus' design.

## IV. Software Design

The software for the Pegasus audio device was developed in the Arduino IDE, primarily leveraging C/C++ libraries to control and monitor the hardware components, particularly the footswitch inputs, rotary switch and LCD display. The LCD display, configured with I2C communication protocol, allows a user to visualize active effects in a structured, intuitive manner. Each effect displayed is a combination of both analog and digital effects controlled via analog and digital pins. This 16x2 LCD is initialized to display those effects across two rows. It is connected to the microcontroller (MCU) via power, ground connections, I2C communication lines, and code configuration. The VCC pin is connected to power and the ground is connected to zero volts. The serial data line (SDL) carries the data signals from the MCU to the LCD and the serial clock line (SCL) carries the clock signal that synchronizes data transfer.

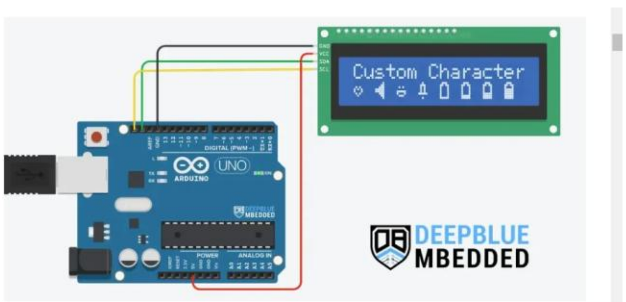


Fig. 3. Atmega328P pin connection to I2C LCD

The analog pins monitor the on/off status of analog effects, achieved by reading voltage levels to determine the position of each footswitch. Through research, we identified that the maximum output voltage for the microcontroller (Atmega328P) is approximately 5 volts, allowing us to establish a threshold at 4 volts. If the voltage drops below 4 volts the effect is recognized as high and shows "on", while a reading at or above 4 volts is interpreted as "off". In the microcontroller design, a threshold of 850 corresponding to an approximate voltage of 4 volts, plays a critical role in detecting the status of footswitches. This threshold is established through the analog-to-digital conversion (ADC) process with the microcontroller. With a 10-bit ADC, the MCU converts input voltages ranging from 0 to 5 volts into digital values from 0 to 1023. Each incremental step in the ADC range corresponds to approximately 4.88 millivolts. Therefore, a reading of 850 equated to around 4.15 volts.

$$Step\ voltage = \frac{Reference\ voltage}{ADC\ range} = \frac{5V}{1024} \approx 0.00488V/per\ step$$
$$Voltage = Step\ voltage \times Analog\ reading = 0.00488V \times 850 \approx 4.15V$$

Fig. 4. Analog Voltage Reading Computation

For digital input, three input pins are configured to read the rotary switch position, allowing us to cycle through various digital effects. This rotary switch is essential for adjusting digital effects through a simple binary-to-decimal conversion, which shifts and interprets the switch's binary reading. The system iterates through each effect based on the switch's position, using case statements to update the LCD display accordingly. Unused digital pins are set as pull-up inputs to ensure stability and avoid floating states, which could introduce noise or errors. Initially, the LCD cursor is positioned to display the names and statuses of two primary analog effects: boost and overdrive. These labels are placed on the top row, with their corresponding statuses shown on the bottom row. By default, both effects are displayed as "OFF". However, as the footswitches FS0 and FS1 toggle the effects on and off, conditional statements update the display to reflect the current effect status. Additionally, the software is designed to monitor the MCU connected to the FV-1 semiconductor chip and the FS2 footswitch managing digital effects. When the footswitch is triggered low the LCD displays "DIGI" when the digital effects are inactive, if triggered high the first digital effect chorus and reverb. To address debouncing issues, a short delay is implemented in the main loop. This delay helps to stabilize the readings and prevent unintended multiple toggles from a single press of the footswitches, ensuring smooth transitions between effects. This structured approach not only simplifies user interaction with the device but also enhances the readability and functionality of the system by using the LCD as a central feedback tool. Each component works in tandem to ensure that both analog and digital effects are easily monitored, controlled, and displayed to the user in real time.

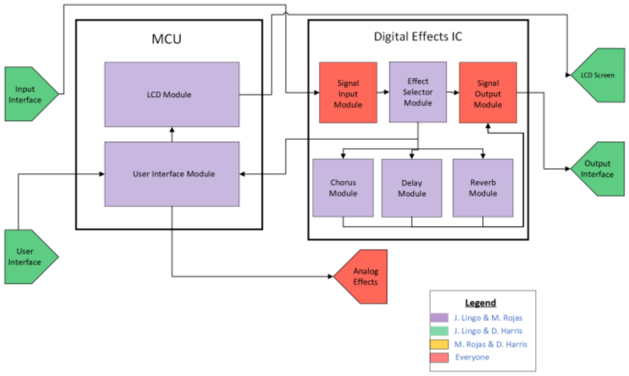


Fig. 5. Software Block Diagram

## V. Enclosure Design

The enclosure for Pegasus was designed with durability, usability, and aesthetics in mind, carefully considering material selection and form factor. Aluminum was chosen as the material for the enclosure due to its lightweight and noise-filtering properties. These qualities make it well-suited for live and studio use, where the device may be subject to physical strain and varied environmental conditions. Other materials, such as steel and high-grade plastics, were evaluated as alternatives. Steel was ultimately dismissed due to its weight, higher cost, and potential conductivity issues, which could increase susceptibility to electromagnetic interference. High-grade plastics, lightweight and cost-effective, were also ruled out due to lower durability, perception in the audio market and its unreliability to filter out noise.

The enclosure dimensions are a length wise 254mm by a width of 125mm by a height of 50mm, allowing the device to occupy minimal space on a musician's pedalboard without compromising functionality. Key components like potentiometers and foot-actuated

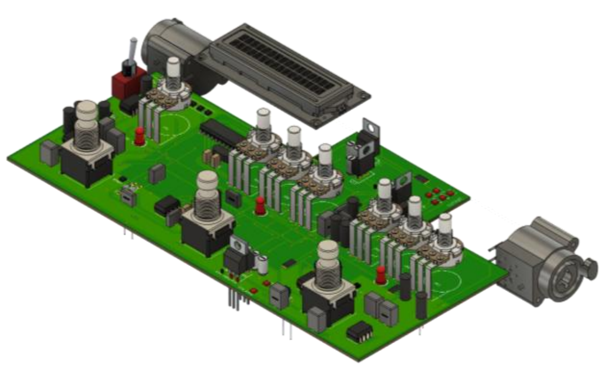

Fig. 6. 3D Rendering of Circuit Board

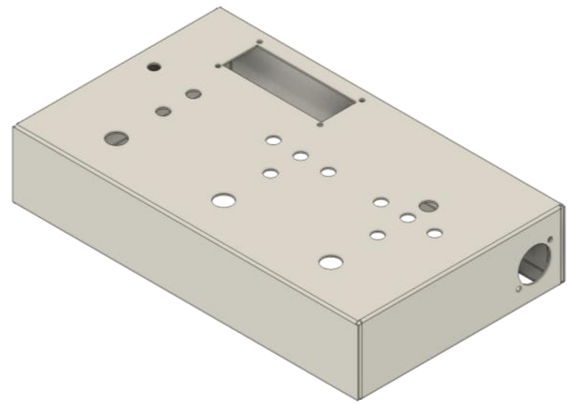

Fig. 7. 3D Rendering of Enclosure

switches are arranged thoughtfully, allowing easy access to multiple buttons at once. The layout is tailored for intuitive operation, so users can make adjustments quickly reinforced without disrupting their performance flow. Figures 6 and 7 show a 3D rendering of the circuit board and its enclosure.

## VI. Testing

After the completion of Pegasus' design and an initial prototype was conducted, a testing phase was initiated to evaluate the functionality and performance of the device. The primary objectives of the testing phase were to assess that each component on the user interface worked as intended, the sound quality was acceptable and that our three main engineering specifications had been met. This section specifies the methodologies used in each test, the equipment used, and the various criteria being judged. By conducting these tests, we aimed to identify any glaring issues with the design of Pegasus and refine the device to deliver a robust, high-quality end product.

### *A. Functionality Testing*

First, a series of functionality tests were conducted to evaluate the user interface and effects modules on the device. These tests were aimed at verifying that all the components and features of Pegasus operated according to our specifications. The testing environment for these trials was set up to match a typical use case for the device. For the input, a Jackson JS22 electric guitar was connected via quarter-inch cable and a dynamic microphone was connected via XLR cable. The output was connected to a Roland Microcube amplifier with a quarter-inch TS cable. The device was powered by a regulated 12V DC adapter.

Initially, bypass functionality was tested to ensure that when all channels are disengaged there was no audible change in the integrity of the audio signal. Next, each footswitch was tested to ensure that it engaged the associated effect module. Then, each of the potentiometer controls associated with each effect module was tested to ensure that they are manipulating the correct aspect of the given effect. For the digital effects, the rotary encoder switch was tested by rotating through each of the available digital effects. Lastly, the LCD screen was monitored throughout each of these tests to ensure that the appropriate message was displayed.

These functionality tests demonstrated that Pegasus operated reliably and meets all design expectations. The device maintained signal integrity and sound quality throughout the tests. The user interface controls were responsive and controlled the intended aspect of the device. Overall, there were no observed failures or issues that came up during these functionality tests.

### *B. Sound Quality Testing*

Sound quality was also observed to assess the sonic performance of Pegasus. The testing setup for these tests was the exact same as the functionality tests. The criterion for these tests is somewhat subjective, but we aimed to test how the device's tonal characteristics, signal clarity and effect integrity measured up to our design specifications.

With all effects bypassed, the device produced no change in the tone or volume of the guitar. The boost effect module resulted in a noticeable gain increase that provided a clean, natural boost at the low to mid-range of the amplification spectrum while added some slight distortion towards the higher end. The overdrive effect produced a warm distortion that did not overpower the sound allowing for good note clarity. For the digital effects, each of the eight settings produced a high-quality effect that matched well with its given name. The chorus-reverb effect gave a rich, shimmering modulation to the sound with a natural-sounding reverb tail. The flange-reverb effect delivered a dynamic sweeping sound with a spacious reverb. The tremolo-reverb effect produced a wobbly pulsing along with an ambient reverb. The pitch-shift effect accurately shifted the sound from high to low pitches. With the pitch-echo effect, harmonically rich echoes were added to the dynamic pitch shift. The through mode worked as intended as a bypass while maintaining signal integrity. Reverb 1 offered a warm, natural sounding ambience like that of a studio plate reverb. Reverb 2 offered a more spacious sounding effect that resembled a hall or large room reverb.

The sound quality tests confirmed that Pegasus enhances or modifies the audio signal in the expected way while maintaining the signal tone and integrity. Little to no extra or unwanted noise was introduced to the sound and the effects proved to be rich and dynamic.

### *C. Engineering Specification Tests*

Table 1 shows the three engineering specification tests we chose to demonstrate. These tests were chosen to validate the technical performance and reliability of Pegasus' design. The results of these tests intend to demonstrate quantitative evidence of the device's quality and degree of engineering effort.

The setup for these tests significantly differs from the functionality and sound quality tests. Though the power for the device was still provided by a regulated 12V DC adapter. The probes of an oscilloscope were connected to a quarter-inch cable plugged into the input and output of the device. Also, connected to the input was a function generator that provided a nominal 1 Volt peak-to-peak sine wave of varying frequency. For each engineering specification, ten tests were performed where the frequency of the sine wave at the input was increased in 1 kHz intervals from 1 kHz to 10kHz. These tests at varying frequencies show that the device performs as intended across a large section of the audible spectrum.

| **Engineering Specification** | **Quantitative Measure** |
|---|---|
| Bypass must not have audible loss in volume | Signal attenuation <1% avg. |
| Bypass must not cause audible latency in signal | Latency < 10ms avg. |
| Boost Effect module must be able to increase peak-to-peak signal amplitude by at least 50% | Output ≥ 150% of input amplitude, when boost is engaged |

Table 1. Engineering Specifications

The first test was a bypass signal attenuation test. The goal of this test was to ensure that there was no significant loss of volume in the output signal when no effect modules were engaged. The voltage of the input signal and the voltage of the output signal were measured with the oscilloscope. The results for each of the ten tests are shown in Table 2. The right-hand column shows the percentage of attenuation the signal experienced from input to output. The bottom row shows the averages of each column. These results indicate that Pegasus meets the desired specification for this test, with an average of 0.71% attenuation.

| Freq. | Vin | Vout | ΔV | % attenuation |
|---|---|---|---|---|
| 1 kHz | 1.1123 | 1.127 | 0.0147 | 1.32 |
| 2 kHz | 1.127 | 1.1221 | 0.0049 | 0.43 |
| 3 kHz | 1.1172 | 1.1319 | 0.0147 | 1.32 |
| 4 kHz | 1.1123 | 1.1123 | 0 | 0.00 |
| 5 kHz | 1.1221 | 1.1172 | 0.0049 | 0.44 |
| 6 kHz | 1.1172 | 1.1222 | 0.005 | 0.45 |
| 7 kHz | 1.1072 | 1.1172 | 0.01 | 0.90 |
| 8 kHz | 1.1123 | 1.1172 | 0.0049 | 0.44 |
| 9 kHz | 1.1172 | 1.1123 | 0.0049 | 0.44 |
| 10 kHz | 1.1172 | 1.1025 | 0.0147 | 1.32 |
| **AVG** | 1.1162 | 1.11819 | 0.00787 | **0.71** |

Table 2. Bypass Attenuation Test Results

The next engineering specification test aimed to measure the latency of the device when all effects were bypassed. There should be no significant audible delay in output signal in this configuration. This latency was measured on the oscilloscope. The results of each of the ten runs of this test are displayed in Table 3 below. The column on the right shows the latency measurements in seconds and the bottom row shows the average of each column. The results from this test all show significantly lower values than the target which means that the device absolutely meets this engineering specification.

The last engineering specification test looked at the amplification of the boost effect module. This test was designed to ensure that the boost effect could increase the output amplitude of the signal by at least 50% of the original input signal. This is significant because the boost effect should provide a noticeable increase to the audio signal. The input and output voltages were measured using with the oscilloscope and the percentage of boost from the input to the output was calculated. The results from this test are displayed in Table 4. The righthand column shows the percentage of boost the input signal received and the row at the bottom shows the average of each column. All of the results show that the device increased the amplitude of input signal by at least 50% meeting the desired specification.

| Freq. | Vin | Vout | Latency (s) |
|---|---|---|---|
| 1 kHz | 1.1123 | 1.1123 | 2.58E-06 |
| 2 kHz | 1.1123 | 1.1123 | 1.43E-06 |
| 3 kHz | 1.1172 | 1.1123 | 1.29E-06 |
| 4 kHz | 1.1074 | 1.1123 | 7.36E-07 |
| 5 kHz | 1.1123 | 1.1123 | 7.36E-04 |
| 6 kHz | 1.1123 | 1.1025 | 1.08E-07 |
| 7 kHz | 1.1074 | 1.1172 | 9.20E-08 |
| 8 kHz | 1.1123 | 1.1074 | 4.51E-07 |
| 9 kHz | 1.1025 | 1.1123 | 3.04E-07 |
| 10 kHz | 1.0976 | 1.1123 | 6.62E-07 |
| **AVG** | 1.10936 | 1.11132 | **0.0000744** |

Table 3. Bypass Latency Test Results.

| Freq. | Vin | Vout | ΔV | % boost |
|---|---|---|---|---|
| 1 kHz | 1.1074 | 1.862 | 0.7546 | 168.1415929 |
| 2 kHz | 1.221 | 1.8669 | 0.6459 | 152.8992629 |
| 3 kHz | 1.1074 | 1.8669 | 0.7595 | 168.5840708 |
| 4 kHz | 1.1123 | 1.8767 | 0.7644 | 168.722467 |
| 5 kHz | 1.1074 | 1.8571 | 0.7497 | 167.699115 |
| 6 kHz | 1.1074 | 1.8816 | 0.7742 | 169.9115044 |
| 7 kHz | 1.1074 | 1.862 | 0.7546 | 168.1415929 |
| 8 kHz | 1.1074 | 1.8669 | 0.7595 | 168.5840708 |
| 9 kHz | 1.1123 | 1.8669 | 0.7546 | 167.8414097 |

| | | | | |
|---|---|---|---|---|
| 10 kHz | 1.1025 | 1.862 | 0.7595 | 168.8888889 |
| **AVG** | 1.11925 | 1.8669 | 0.74765 | **166.7991959** |

Table 4. Boost Output Amplitude Test Results

These engineering specification tests show that Pegasus has been designed with a certain level of rigor and attention to detail. The evaluation here demonstrates that Pegasus is functionally robust and is comparable with similar devices already on the market.

## VII. Conclusion

The development of the Pegasus multi-effect audio device has demonstrated a strong commitment to fulfilling rigorous engineering and user-centered design requirements. Through a careful selection of components and testing processes, the team addressed critical performance factors like signal clarity, latency, and boost output. Engineering specifications, such as signal attenuation under 1 percent and latency below 10 milliseconds, were consistently achieved across various test frequencies, showcasing the device's robustness and responsiveness. The amplitude results highlight the device's effectiveness in amplifying the audio signal without compromising sound quality.

The project's accomplishment thus far serves as a solid foundation for further refinement and testing. Additional features can be explored like refining user interface elements, along with the enhancement of others. With careful attention to both technical and practical considerations, the Pegasus device is well-positioned to meet the needs of musicians looking for a versatile, reliable, and performance-enhancing device. This project demonstrates the team's capability to address both engineering challenges and user needs, bringing the device closer to its goal of bridging the gap between entry-level and professional-grade audio equipment.

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