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AUDIO MIXER 4 CHANNELS STEREO

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Abstract: In audio equipment, a mixer is a tool that is well known and widely used by lovers of 4-channel stereo channel audio mixers such as those used in recording studios, broadcasting stations and so on, all of which function to mix several signals, in adjustable ratios - set with a potentiometer. In the world of electronics, signals can be mixed by adding them up. This research discusses the performance of a 4-channel audio mixer system, the simplest stereo channel consists of two channels and can be developed up to tens of channels. Four channels as microphone amplifiers and two channels (R and L) for lines that can be connected to tape, tuner, compact disc and others, as well as two output channels 1 (R and L) and output channels 2 (R and L) which can be connected to a power amplifier.
Keywords: Audio, Channel, Mixer.

INTRODUCTION

Mixer is one of the electronic devices that is widely known by the public, which is now almost - almost we meet on stages, single organs. The mixers used in big shows have dozens of inputs, according to their needs. However, for ordinary events such as a single organ, only four channels are sufficient. By using this tool, the vocals / sound produced will be manipulated according to the character of the vocals so that the sound produced will be good. To manipulate the vocals, you can adjust the bass, trible, effects, middle on the microphone amplifier and on the mixer (mixer). 4 channel Audio Mixer is very useful for music studios, recording studios, broadcasting studios and so on. The mixer that is used at home as karaoke is enough for just four channels.

The specifications of this mixer circuit, the researcher tries with a 15 Volt, 1 A power supply for the mixer and the micro amplifier, the researcher tries to use 12 Volt, 1 A for the echo circuit. The development of the mixer mentioned above led to the idea to research other benefits of one of the existing mixers. on this occasion the researcher tried to develop a 4-channel audio mixer in another form. The circuit used is the same as in the subjects studied such as op-amps, transistor amplifiers, tone regulators. There are a lot of these tools in the market, but researchers have made these tools simpler and easier to learn and understand. The four micropun channels in question are the four micropun input channels. Generally, this input is also used by the power amplifier input so that the output can be made stereo by the pre-amp. The volume for the pre-amp micropun is set to taste and the volume for the master micro is the same. So that the sound produced is not broken / shrill caused by a signal that is too large at the output. The tool can be operated easily compared to mixers on the market in general. This tool is not inferior in quality to the tools on the market, the tool has additional / supporting circuits so that there are no difficulties in testing, namely the power amplifier. The power amplifier has an amplifier of 18 Watts, while the IC used is the LA 4440.

RESEARCH METHOD

4 Channel Audio Mixer Block Diagram Section

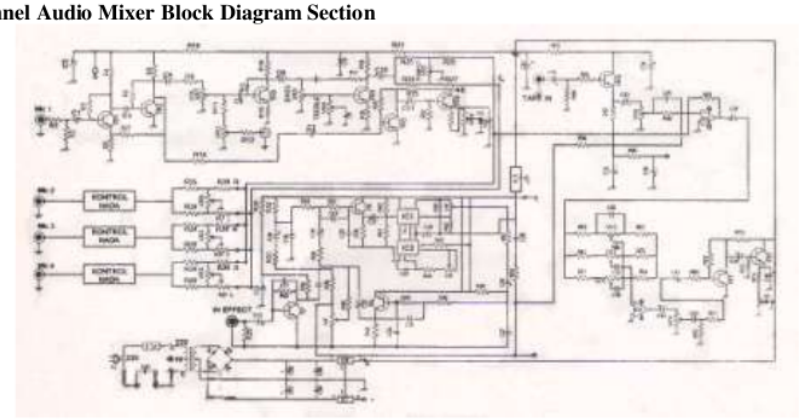

Figure 1. Mixer Diagram Blok 4 Channels

In the mixer block diagram it is explained by dividing the blocks to be explained as follows:

Microphone / Pre-Mic Amplifier Schematic

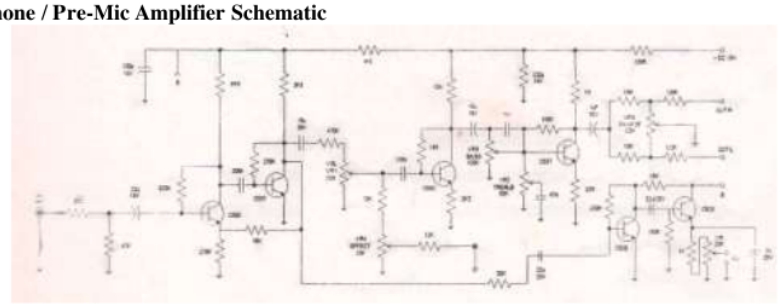

Figure 1. Schematic Amplifier Microphone / Pre-Mic

From the input transistor towards the base, a resistance R_1 is installed, namely 2k2, in series with a 22 μF / 16 V condenser towards the transistor, from the leg of the input resistance it is grounded, while from the leg of the condenser, it is paralleled with resistance R_2, which is 47 K towards ground. while from the positive condenser the direction of the base of the transistor is coupled between R_3 620 K with resistance R_4 5K6 the direction of the base to the collector of the transistor towards the output voltage. This circuit is a feedback circuit, namely R_1, codensator, R_4, R_3 and R_4 is an amplifier (or heat shield from the voltage towards the transistor). From the emitter of the transistor, R_5 270 R is series towards ground, from kaka the emitter direction resistance is paralleled with R_6 resistance, which is 15 K by being jammed towards transistor type C 537. Therefore, the transistor as an amplifier element of these circuits functions so that no noise occurs in the microcircuit.

So, in this circuit the transistor is as an amplifier element of the micro channel. Therefore, the function of the type 537 transitor is useful as a panpot amplifier to determine the right and left directions, while the function of the panpot is a potentiometer which is useful for adjusting the weak strength of the incoming signal to the R and L channel mixer.

Mic Amplifier Schematic Circuit with Two Gains

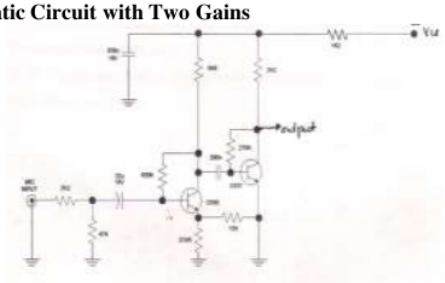

Figure 3. Microphone amplifier with two gains

The function of each component R_1 = 2 k2 as a barrier to incoming signals on the microphone. R_2=47k removes unwanted frequency noise. R_3 = 820 is useful for setting direct current IB to make it more stable. R_4 = 5k6 this component is used to withstand the DC current / voltage so that it is more controlled / stable. R_5 = 270 ohm, this function is to remove the resulting noise signal. R_6 = 270 k unidirectional adjustment IB for more stability. R_7 = 15 ohms to connect the output of the reinforcement / procurement results. R8 = 2k2 as a DC current / voltage regulator to make it more controllable or stable. C_1 = 22 µF/ 16v this component is useful for preventing DC currents or voltages from entering. C_2 = 330 μF / 16 v to prevent DC current/voltage from entering. C_3 = 200 µF / 16 v stabilizes the DC current / voltage, while the use of the 550-type transistor as an amplifier with a two-gain system.

Tone Control Schematic Circuit

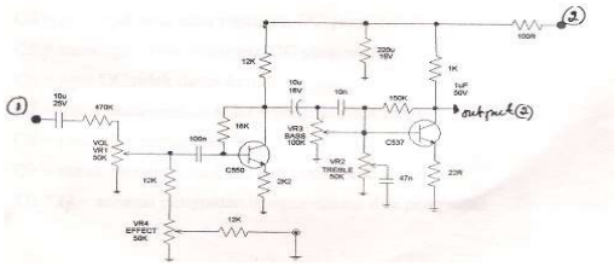

Figure 2. Tone Controller Schematic Circuit

The function of each component R_9 = 470 k This component functions as a buffer for signals that enter the volume. R_{10} = R_{11} = 12k serves as a suppressor and strengthens the incoming echo signal that can be withheld. R_{13}=18k is for setting direct current IB to make it more stable. R_{14}=12k current control / DC voltage is controlled / stable. R_{15} = 2k2 as a waster for the noise signal it produces. R_{17} = 150 k for direct current adjustment IB to make it more stable. R_{18} = 1k serves as a current / voltage barrier to make it more controllable or stable. R_{19} = 22k as a waster for the generated noise signal. C_4 = 10µF/25v this component is used to prevent or incoming DC voltage. C_5 = 100µF/25v this component functions as a barrier to prevent incoming DC current / voltage. C_6 = 10 µF/16v so DC current can't get out. CµF = 10Nf this component determines the frequency range in the base. C_8 = 220µF/16v is used for DC stabilizer / filter. C_9 = 14 nF to determine the range of frequencies in the treble. The type 537 transistor functions as a reinforcement with a two-gain system.

Panpot Schematic Series

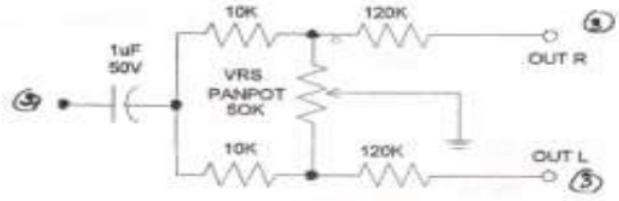

Figure 5. Panpot Schematic Series

The function of each component is R_{21}=R_{22}=10k, this component functions as a barrier to incoming signals from the tone controller so that hum does not occur. This R_{25} = R_{26} = 120k is a signal thrower that comes out to the right or left. Meanwhile VR_5 = 50 k , as a signal waster that comes out to the right or left . C11 = 1 μF/ 50v, this component is used to prevent incoming DC currents / voltages.

Volume unit schematic circuit

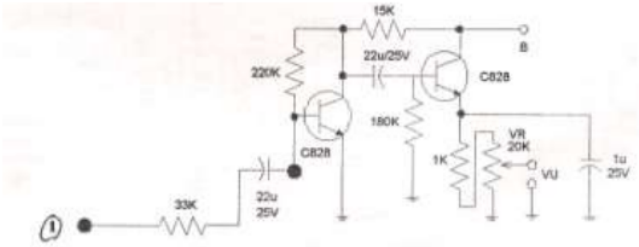

Figure 6. Volume Unit Schematic Circuit

The function of each component R_{16} = 33k, as a base resistance so that signals that enter the output transistor base are stabilized. R_{19} = 220k, only as a direct current adjustment IB to make it more stable. R_{23} = 15k, serves to withstand a more stable positive current / voltage. R_{24} = 180k, for frequency noise cancellation. R_{25} =1k, only for the stabilizer at the emitter output. VR_6 20k, as a function of the controller on the volume unit (VU) tool. C_{10} = 22µF/25v, this component is to assist in suppressing any frequency noise. C_{12} = 22µF/25v, this component is useful for attenuating the noise present in the collector. C_{13} = 22µF/25v, serves as the inverting frequency noise. The 550 type transistor acts as an amplifier in the circuit.

RESULT AND DISCUSSION

The results of the discussion taken by the author are as follows: 1, namely a way of collecting data based on electronic theory related to the tools made. And based on the data sheet of the components used, namely Integrated Circuit (IC). 2. Assemble the tool based on the existing circuit. 3. Perform testing of the tool to then analyze the performance of the tool.

Block Diagram 4 Channel Stereo Audio Mixer

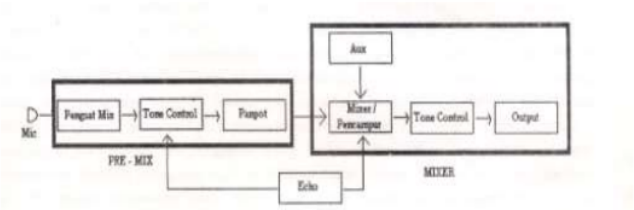

Figure 7. Block Diagram 4 Channel Stereo Audio Mixer

Micropun (Mic), this section is part of the tool that generates input signal micropun. Microup amplifier and tune control, this section functions to process the signals received by the microphone. These signals are used by the C 945 transistor and these signals are processed into low-frequency, high-frequency, echo-frequency signals. In this section the output signal is mono which is then made into stereo. This stereo signal imitation occurs at the panpot using a parallel resistor to detect signals coming out of the micro amplifier which is amplified using a Volume Unit (VU) so that the vocals that are issued as sound are not torn apart and deformed. The trimpot on the VU is to adjust the sensitivity of the Volume Unit needle. Mixer and Tone control, this section functions to mix the signals received from the mic amplifier, echo generator (Echo), input line (auxiliary). This block is generally referred to as the master. The master consists of two parts, namely the right master and the left master, each master is made mono. The signal input of the mic amplifier (Pre-Mic), the echo generator (Echo) as a return from the input line (auxiliary) is connected to the 741 op-amp circuit in an inverting manner whose input is connected to some input resistance. In this way, the amplifier gain is obtained. The output of the mixer / mixer is connected to a tone regulator, which uses an op-amp 741 amplifier commonly called a three-band active tone regulator - bass tone, midrange and treble. A VU meter is installed at the output stage of the mixer circuit, it aims to determine the operation of the

amplifier in such a way that the peaks are reproduced incorrectly. So that the music that is issued as sound will be torn apart and deformed. For this reason, a Volume Unit meter is installed which is included with the trimpot to adjust the sensitivity of the Volume Unit needle. Assist arar entry, this section serves as a signal input that can be connected to a tape deck, compact disc, tuner, organ / keyboard and others. The input stage is connected to an impedance matcher circuit which functions to match the impedance of the input/aux line to the impedance of the transistor amplifier. Help the input line using a very simple circuit using only a few transistors, a capacitor and one C945 transistor. The output of this section functions as an output signal from the mixer section, at this output it is connected to a power amplifier. The block has two outputs, namely output 1 and output 2. Each output consists of right and left or stereo. The common use for this block is the final part.

Echo, this section functions to produce echo sound, in this block the output is connected to the mixer block or is called return. the input of this echo generator is connected to the microuppun amplifier block or what is called an affect. For the echo generator circuit carried out by IC MN3207 and IC3102. Setting the number of echoes produced by this circuit is regulated by a potentiometer. While the trimpot functions to eliminate hum, if you only want input 1, use echo, affecting the input that is raised, while the potential affects the others in a minimum (zero) state. If you want all lines to use echo, the potential will affect each channel. From the potentiometer this signal is amplified by the transistor and the surrounding components.

The transistor is an active component and is also a semiconductor component which has three connecting points, namely base, emitter and collector. Which transistor has two types, namely the type of PNP and PMP if the emitter is placed at the negative voltage, then for the PNP it is at the positive. the use of transistors in general has several uses, namely the transistor as a switch and the transistor as an amplifier, on this occasion the circuit has a transistor as an amplifier. This transistor has three operating areas, namely the plug point, saturation point, active region (active region). The transistor as a switch works in two operating areas at the saturation point and the plug point. Which this transistor will work by conducting current when the transistor is at saturation point (the switch will turn on), while at the plug point the transistor does not conduct current. In general, the collector current (Ic) will increase as the base current (Ib) increases, the collector current will increase so that the collector current will approach a constant, with the following equation: Ie = Ic + Ib.

Table 1. Characters in the 3 Operational Regions of a Transistor

Condition	Diode B/E	Diode B/C	Ic and Ib	Aplication	Voltage Vce
Termination	Bias Revers	Bias Revers	Ic = 0 , Ib = 0	Switch Off	Vcc >> 0
Saturation (On)	Bias Forward	Bias Forward	Ic < Ib	Switch On	Vce0– 0,2V
Active	Bias Forward	Bias Forward	Ic = Ib	Amplifier	Vce >> 0

The table above shows the characteristics of the transistor through a refraction that is different for each of its constituent diodes. In the collector circuit the voltage source for Vcc will reverse bias the collector diode through Rc. So that this voltage will be obtained by the equation Vce = Vcc - Ic. Rc. In this circuit for Vcc and Rc are fixed (constant), while the value for Vce is a variable. The condition of cutting off the transistor (plug point), the point is that in this area the base current = 0 and the current in the collector is small, so this current can be ignored but what happens is Ice 0 which is a leakage current caused by a current on the leaky surface. At the point where the emitter diode is plugged, it loses its forward bias and normal work on a transistor stops.

The transistor in the cut off state is considered a common emitter circuit in which the collector resistance is connected in series with the emitter so that the supply voltage (Vcc) is equal to Vce (Vcc = Vce) and even this state is ionized Vc (Ic Rc) and the collector current Vce flows through the collector resistance. and the voltage drop is Ic Rc. If the transistor is considered a switch, then the switch is different in the open state, so the switch will turn off. The transistor is said to be cut because the base has a negative bias (reverse) which is large enough so that it will cut off (cut off) the collector current for this state Ic Rc = 0, so that the supply voltage is equal to the voltage between the collector and emitter.

The active region (active region) in the region of all operating points between the two points was discussed in the above section regarding the active region of the transistor. In this active region the emitter diode is forward biased and the collector diode is reverse biased. Where the intersection of the base and the load is the Q (quiet) point. In this area the ability of a transistor as an amplifier can be enabled.

Op- amp 741

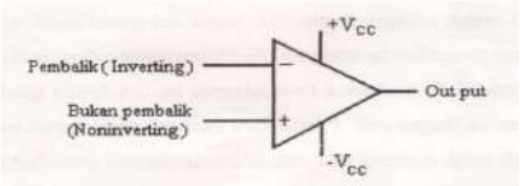

Figure 3. Op- amp 741

Operational amplifier or op-amp is an electronic circuit that is specially designed and packaged so that by adding a few external components it can be used for several purposes. An op-amp IC is a solid-state device capable of sensing and amplifying both dc and ac input signals. A typical op-amp IC consists of three basic circuits, namely a high input impedance differential amplifier, and a low impedance output amplifier usually a push-pull emitter follower. The standard op-amp symbol is represented by a triangle, as shown in Figure 2 above. The input terminals are at the top of the triangle, the reverse input is indicated by a minus sign (-). The DC or AC voltage that is controlled at this input will be phase shifted 180 at the output, the input is inverted, not inverted, indicated by a plus sign (+). DC or AC voltage supplied at the top of the triangle. The supply terminals and other pins for frequency compensation or zero adjustment are shown at the top and bottom of the triangle. High input impedance differential amplifier, high gain voltage amplifier with a level shifter (so the output can swing positive or negative), and low impedance amplifier one of the important functions to remember is the polarity relationship of the input to the output strictly speaking, similarly if the inverting input is more negative than the noninverting input, the output will be positive.

Microphone Amplifier Schematic Circuit

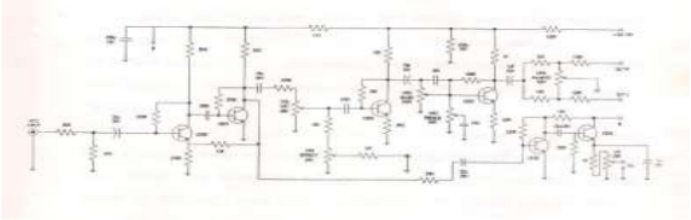

Figure 9. Microphone Amplifier Schematic Circuit

The microphone amplifier shown in Figure 9 above explains how to analyze the microphone test at a distance of 1 meter against a 6-inch speaker, explained below:

Table 2. Micropun distance of 1 meter to Speaker 6 inc

Volume	BASS Potensio Round				TRIBLE Potensio Round				EFFECT Potensio Round			
	90	180	270	360	90	180	270	360	90	180	270	360
50%	-10	-1	-5	-10	-10	-1	-5	-10	-10	-5	-9	-10
75%	+1	-5	-5	-10	+1	-5	-5	-10	+1	-5	-5	-10
100%	-2,5	-5	-7	-10	-2,5	-5	-7	-10	-2,5	-5	-7	-10

At 50% mic volume and 90° the sound produced is bass, treble, which is produced as a sound like the original, there is no protrusion of bass and treble. While the echo (echo) is input, even at the volume of microup 50% 180° the sound is normal, the protrusion of the bass is starting to look very good, but the effect on the echo is still not echo enough. microup volume is 50% and 270° the sound produced by the bass is very large, the treble is sufficient and the echo effect starts to reverberate but the volume produced is not normal as sound, because the bass sound is prominent, it still dominates it.

At 50% microphone volume and 360° rotation the sound produced by the bass is very large, the treble is very sufficient, the effect resounds but the vocals are produced as an abnormal sound, because there is still a protrusion of the bass sound, to overcome this, a distance of 1 meter microphone to the speaker. For 360° bass rotation, treble, effect in 75%, the sound produced by the bass is very large, treble is enough and the effect is also very good.

Distance of 1 meter microup and 6 inc speakers for 100%, for 180° rotation bass, treble, the sound effect produced by bass is sufficient, treble is enough echo is still lacking, abnormal sound is caused by noise, for tuning so that noise does not occur, then by cutting the volume of the treble is 180° to 90° then the resulting sound is balanced and normal.

The distance of 1 meter microup and 6 inch speakers for 100%, for 270° bass rotation, treble, and affects the resulting sound as an abnormal and unstable sound, causing the input to repeat this, then the treble and bass rotation must be cut from 270° becomes 180° then the resulting sound becomes normal and stable.

Distance of 1 meter microuppun and 6 inc speakers for 100%, for 360° rotation bass, treble, the sound effect produced at this position is very big bass, very high treble echo echoes then the resulting vocals are not balanced and input to repeat it then by cutting it bass volume, and treble from 360° to 180°, the resulting vocals sound normal and stable. there is no input and the result is that after reducing the bass volume and treble volume, the results for vocals as a sound are very good.

Table 3. 3 meter Mic Distance To Speaker 6 inc

Volume	BASS Potensio Round				TRIBLE Potensio Round				EFFECT Potensio Round			
	90	180	270	360	90	180	270	360	90	180	270	360
50%	-7	-5	-7	-10	-7	-5	-7	-10	-7	-5	-7	-10
75%	-7	-10	-7	-10	-7	-10	-7	-10	-7	-10	-7	-10
100%	+3	-5	-7	-10	+3	-5	-7	-10	+3	-5	-7	-10

In the 50% position the sound produced is like the original sound does not echo, there is no treble sound and the bass effect has not come out either because at this position the sound produced is still original. Normal sound and effects come out less echo when the volume is 75% treble has started hissing bass is enough.

In the 100% volume rotation position, a distance of 3 meters between the microphone and the 6-inch speaker, the input becomes what if the microphone is in the opposite position, the treble is completely out because the volume is 100%, so the resulting output is too large at the micro-volume position, causing noise.

Even at 50%, even in the microup volume rotation, in position 360° bass, treble, the sound effect produced by the bass is very large, the treble is very sufficient, the echo is very dominating which is produced, it still remains on the bass because at position 360° the sound of the bass is very large, the sound produced in this trial is not balanced, the vocals produced as sound, for that the researchers made a good alternative to rotation of the bass, 360° reduced to 270°, the vocals after that became balanced and the results were very good.

75% In the effect rotation 270° bass 270° treble 270° the treble comes out, the bass output is sufficient, the echo is echoing, while with the effect rotation 360° bass 360° treble 360°, the output of the treble signal is sufficient because the microup position is sufficient. In 75% rotation effect 360° bass 360° treble 360°, the output of the treble signal is sufficient, the output of the bass signal is large, the output of the echo signal is very resonant and this position is a micro sound in the input state when the position is faced with the 6 inc speaker.

100% In 180° rotation the bass, treble, effect, bass cues become very large, moderate treble and echo don't come out because they are covered with bass and treble sounds, even in this position the microphone facing the 6-inch speaker becomes too input. 100% in 270° rotation bass, treble, effect, bass signal becomes very big, medium treble and echo are already echoing. In this position the sound obtained becomes input because the volume of the micropunch is too large. To overcome this, the researcher tries to cut 180° to 170°, so the results obtained are clean.

Schematic echo / effect circuit

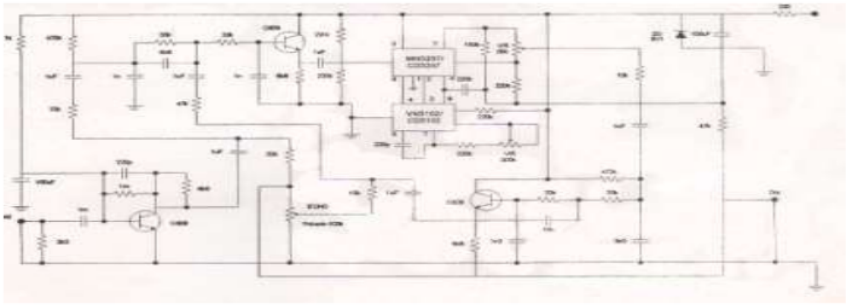

Figure 10. Schematic echo/effect circuit

Table 4. 2 Meter Microphone Distance Against 6 Inch Speakers

Volume	BASS Potensio Round				TRIBLE Potensio Round				EFFECT Potensio Round			
	90	180	270	360	90	180	270	360	90	180	270	360
50%	-3	-5	-7	-3	-3	-5	-7	-3	-3	-5	-7	-3
75%	-3	-4	-5	-4	-3	-4	-5	-4	-3	-4	-5	-4
100%	-5	-10	-6	-10	-5	-10	-6	-10	-5	-10	-6	-10

At 50% rotation, the mic volume is 90° bass, treble, effect. In this rotation position, the sound produced is still like the original, only the treble sound is visible (heard), the bass sound effect as an echo is not heard at all as an echo, this is a vocal that comes out as a sound, no feed back occurs. At 180° rotation on bass, treble, effect at 50% volume on microup, the sound produced is still not too flashy, only the treble dominates the rotation for this 180° rotation, bass as in position 90° effect (echo) has shown its function and there is no input at this setting position.

At 270° rotation on the bass, treble, effect at 50% volume on the microup, the sound produced is unstable because the bass sound is more dominant here, for that it is stabilized so that the vocals come out as a better sound, then with the condition that the bass volume was 270°, cut to 180°, the volume that comes out as sound becomes balanced and the output is stable.

At 90° rotation on bass, treble, effect at 75% volume on microup, the sound produced is louder, the treble is higher and the bass is sufficient but the effect has not resounded, here inputs are starting to occur which are caused by high treble.

At 180° rotation on bass, treble, effect at 75% volume on microup, the sound produced as a bass sound is sufficient, very high treble input is not maximized, here there is very high input, for this you need to overcome this by cutting the treble volume, from 180° to 150° in this way the input doesn't happen again, but the vocals that come out as sound are not what the researchers want, that is, they are not stable.

At 270° rotation on bass, treble, effect at 75% volume on microup, the sound produced is a bass sound, very big and the treble is sufficient, the effect as an echo echoes, but the vocals produced are unstable, for that we need to overcome this, namely by cutting the bass volume 270° to 200°, after that it is tested again, the results obtained by the researchers are very good results obtained.

At 360° rotation on bass, treble, effect at 75% volume on microup, the sound produced is sound, the bass is too big and the treble is sufficient, the effect echoes because the bass is too high, the vocals come out as unstable sounds, for that it is necessary countermeasures, by cutting the bass volume which is 360° to 180°, then after the researchers tested again the results obtained were stable and the results from the input were excellent.

At 270° rotation on bass, treble, effect at 100% volume on microup, the sound produced as a very large bass sound and high treble, the effect as an echo echoes, but in this position the input becomes very loud, it needs countermeasures, so the researchers tried the master of the mixer was lowered from 100% to 45%, the bass volume was lowered from 270° to 250°, so after testing again the results were very satisfactory, no noise and squeaking, even stable and controlled.

Schematic echo / effect circuit

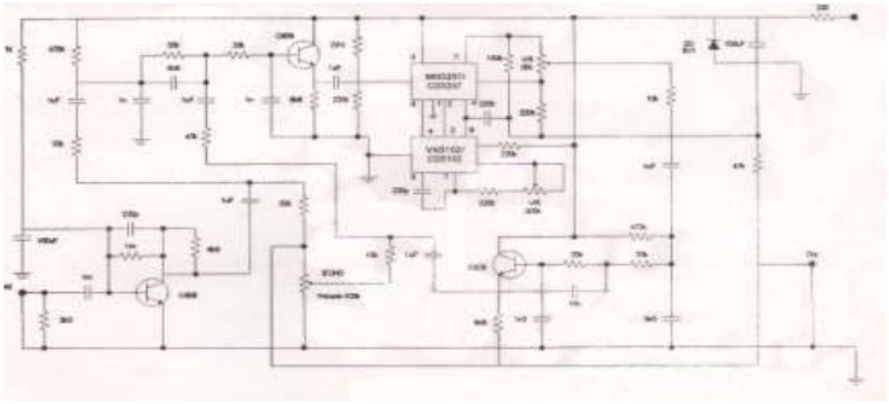

Figure 10. Schematic echo / effect circuit

In the 10th picture in the echo / effect schematic series the researcher is only trying to describe in this study the 50% volume. 75%, 100%, which will be explained in the following table:

Table 5. Regarding how echo / effect works

Volume	BASS Potensio Round			
	90	180	270	360
50%	-5	-1	-5	+3
75%	+3	+3	-5	+3
100%	+3	+3	-5	+3

Input occurs by rotating the volume 360° on the echo, so to mitigate this, the volume of the master 100% is reduced to 50%. So the results obtained by the testers are very satisfying. Meanwhile, with the bass volume. Very good overall sound output as vocals.

Figure 4. Audio Mixer 4 Input Channels Made Viewed From Front

As has been discussed the schematics and how it works previously above.

Figure 5. Audio Mixer 4 Line Input Created Viewed From Rear

Figure 6. Audio mixer 4 input lines made view from the side

Figure 7. Audio mixer 4 The input channel is viewed from the side

Audio Mixer 4 The streo line that the researchers made is not inferior to the manufacturer's production, it even has advantages from an economic point of view, namely without buying a power amp and echo and so on, it can be used directly for karaoke.

The difficulty factor for making this 4-track stereo audio mixer is: to drill the acrylic 5 inches in stages, from the smallest to the largest drill bit so that it can enter for the size of the potentiometer. And this uses up 48 pieces of power glue. it's all glued together.

Figure 8. Audio mixer 4 Input line made from the manufacturer.

Figure 9. Factory-built 4-Way Audio Mixer

Figure 10. Factory-built 6-Way Audio Mixer

The advantages of the mixer made by the manufacturer regarding the boox from the manufacturer are indeed stronger and patented, compared to the one made by the researcher Mixer Audio 4 stereo input lines, the book is made of 5-inch acrylic using 48 power glue glue, and the disadvantages of this 6-channel input mixer must require a power amp and the Echo is also not installed in it. If you look at it from an economic point of view, the production of the manufacturer still really needs more funds when compared to the product from the Miixer researchers, if you want to use it can directly.

CONCLUSION

The results of the conclusions that the writer can conclude based on the results of the 4 Channel Stereo Audio Mixer tool are as follows:

By doing some good settings for the microphone, master, echo, the vocals produced by the microphone are amplified or controlled by a series of pre-mic circuits. Where a microphone generates a signal, then the input from the microphone amplifier can receive signals from the microphone. And this master functions as a mixer of signals from microupon reinforcement and echo generator (echo). So that the vocals produced as sound can be controlled as well as possible. Because on the pre-mic circuit.

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