

Portable Mixer

High-quality modular design
9V Battery powered - Very low current drawing

Design description:

The target of this project was the design of a small portable mixer supplied by a 9V PP3 battery, keeping high quality performance.

The mixer is formed assembling three main modules that can be varied in number and/or disposition to suit everyone needs.

The three main modules are:

Input Amplifier Module: a low noise circuit equipped with a variable voltage-gain (10 - 100) pre-set, primarily intended as high quality microphone input, also suitable for low-level line input.

Tone Control Module: a three-band (Bass, Middle, Treble) tone control circuit providing unity-gain when its controls are set to flat frequency response. It can be inserted after one or more Input Amplifier Modules and/or after the Main Mixer Amplifiers.

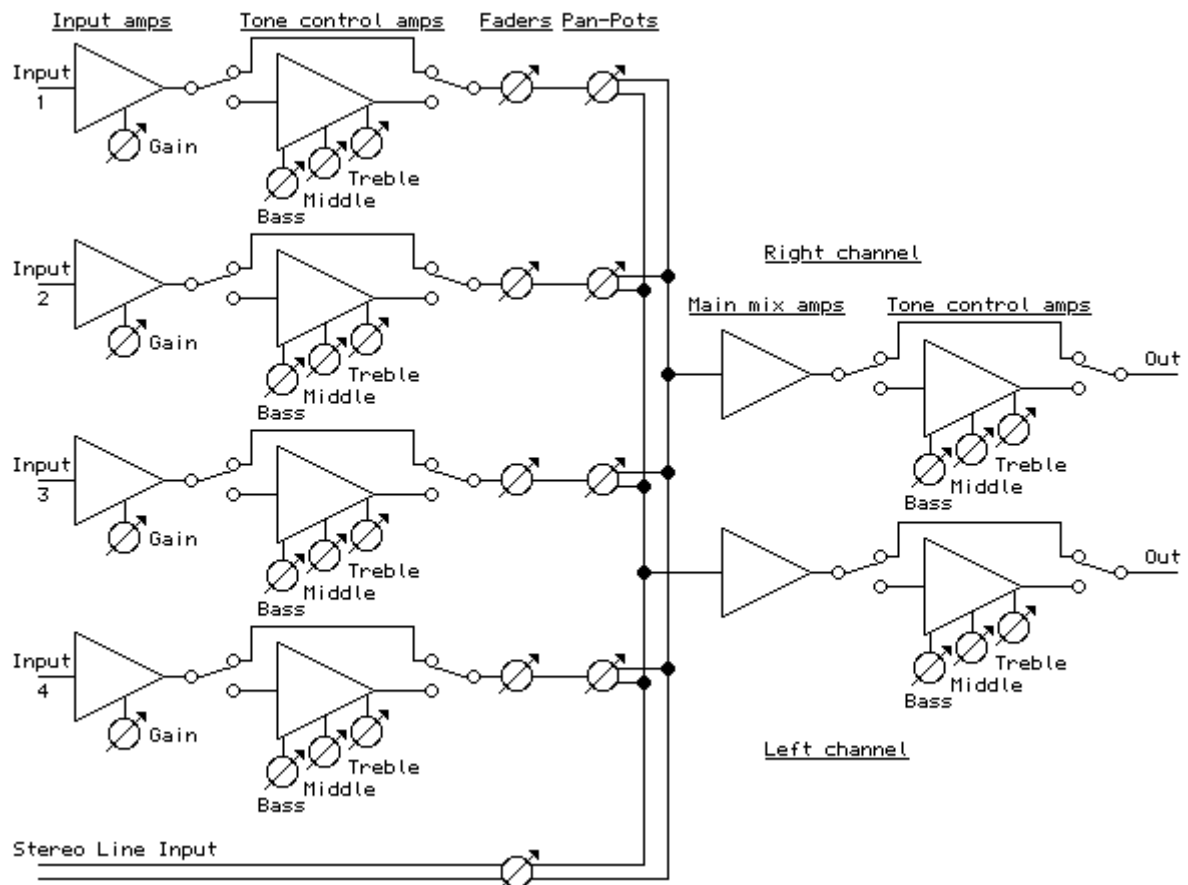
Main Mixer Amplifier Module: a stereo circuit incorporating two virtual-earth mixers and showing the connection of one Main Fader and one Pan-Pot.

The image below shows a Block diagram of the entire mixer featuring four Input Amplifier Modules followed by four in-out switchable Tone Control Modules, one stereo Line input, four mono Main Faders, one stereo dual-ganged Main Fader, four Pan-Pots, a stereo Main Mixer Amplifier Module and two further Tone Control Modules switchable in and out for each channel, inserted before the main Left and Right outputs.

Obviously this layout can be rearranged at everyone wish.

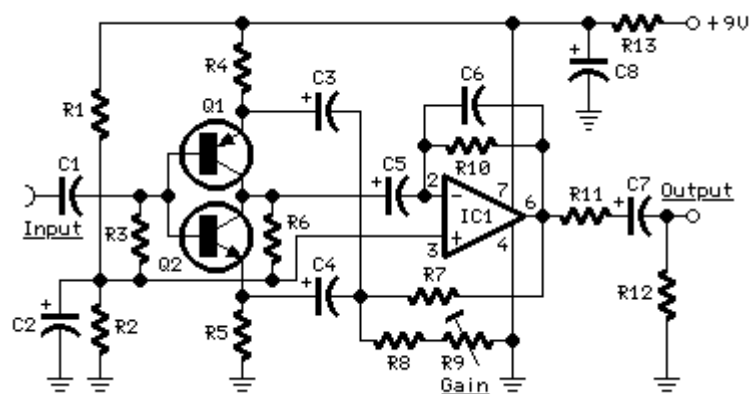
An astonishing feature of this design lies in the fact that a complete stereo mixer as shown below in the Block diagram draws less than 6mA current!

Block diagram:



Input Amplifier Module

Circuit diagram:



Parts:

R1,R2,R7	22K	1/4W Resistors
R3,R4,R5	47K	1/4W Resistors
R6	4K7	1/4W Resistor
R8,R13	220R	1/4W Resistors
R9	2K	1/2W Trimmer Cermet (See Notes)
R10	470K	1/4W Resistor
R11	560R	1/4W Resistor
R12	100K	1/4W Resistor
C1	470nF	63V Polyester Capacitor
C2,C8	100 μ F	25V Electrolytic Capacitors
C3,C4,C5	2 μ 2	63V Electrolytic Capacitors
C6	47pF	63V Ceramic Capacitor
C7	4 μ 7	63V Electrolytic Capacitor
Q1	BC560C	45V 100mA Low noise High gain PNP Transistor
Q2	BC550C	45V 100mA Low noise High gain NPN Transistor
IC1	TL061	Low current BIFET Op-Amp

Circuit description:

The basic arrangement of this circuit is derived from the old Quad magnetic pick-up cartridge module.

The circuit was rearranged to cope with microphone input and a single-rail low voltage supply.

This low-noise, fully symmetrical, two-transistor head amplifier layout, allows the use of a normal FET input Op-Amp as the second gain stage, even for very sensitive microphone inputs.

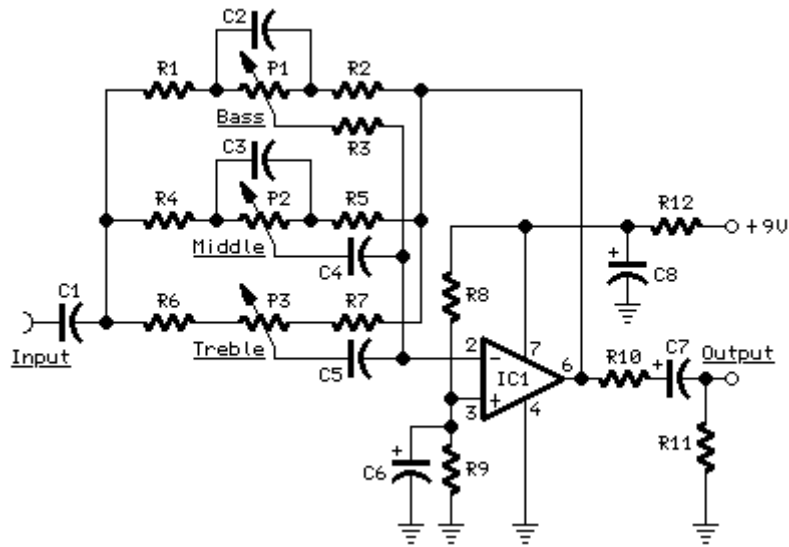
The voltage-gain of this amplifier can be varied by means of R9 from 10 to 100, i.e. 20 to 40dB.

Notes:

- R9 can be a trimmer, a linear potentiometer or a fixed-value resistor at will.
- When voltage-gain is set to 10, the amplifier can cope with 800mV peak-to-peak maximum Line levels.
- Current drawing for one Input Amplifier Module is 600 μ A.
- Frequency response is 20Hz to 20KHz - 0.5dB.
- Total Harmonic Distortion measured with voltage-gain set to 100: 2V RMS output = < 0.02% @ 1KHz; < 0.04% @ 10KHz.
- Total Harmonic Distortion measured with voltage-gain set to 10 & 33: 2V RMS output = < 0.02% @ 1KHz & 10KHz.
- THD is much lower @ 1V RMS output.
- Maximum undistorted output voltage: 2.8V RMS.

Tone Control Module

Circuit diagram:



Parts:

P1,P2 _____ 100K Linear Potentiometers
P3 _____ 470K Linear Potentiometer

R1,R2,R3 _____ 12K 1/4W Resistors
R4,R5 _____ 3K9 1/4W Resistors
R6,R7 _____ 1K8 1/4W Resistors
R8,R9 _____ 22K 1/4W Resistors
R10 _____ 560R 1/4W Resistor
R11 _____ 100K 1/4W Resistor
R12 _____ 220R 1/4W Resistor

C1 _____ 1 μ F 63V Polyester Capacitor
C2 _____ 47nF 63V Polyester Capacitor
C3,C5 _____ 4n7 63V Polyester Capacitors
C4 _____ 22nF 63V Polyester Capacitor
C6,C8 _____ 100 μ F 25V Electrolytic Capacitors
C7 _____ 4 μ 7 63V Electrolytic Capacitor

IC1 _____ TL061 Low current BIFET Op-Amp

Circuit description:

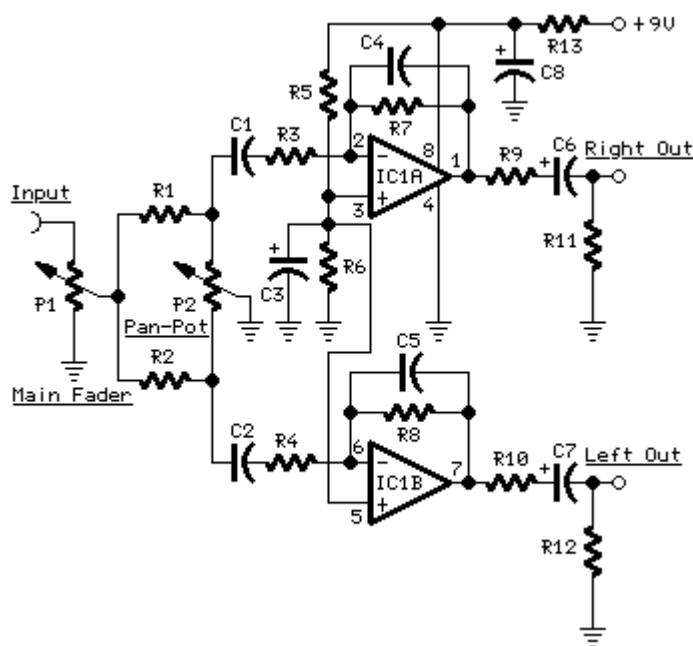
This is a straightforward design using the Baxandall-type active circuitry slightly modified to obtain a three-band control. Total voltage gain of this module is 1 when controls are set in their center position.

Notes:

- Current drawing for one Tone Control Module is 400 μ A.
- Frequency response is 20Hz to 20KHz - 0.5dB, controls flat.
- Tone control frequency range: ± 15 dB @ 30Hz; ± 19 dB @ 1KHz; ± 16 dB @ 10KHz.
- Total Harmonic Distortion measured @ 2V RMS output = < 0.012% @ 1KHz; < 0.03% @ 10KHz.
- THD is below 0.01% @ 1V RMS output.
- Maximum undistorted output voltage: 2.5V RMS.

Main Mixer Amplifier Module

Circuit diagram:



Parts:

P1, _____ 100K Linear Potentiometer
P2 _____ 10K Linear Potentiometer

R1,R2, _____ 15K 1/4W Resistors
R3,R4,R11,R12_ 100K 1/4W Resistors
R5,R6 _____ 22K 1/4W Resistors
R7,R8 _____ 390K 1/4W Resistors
R9,R10 _____ 560R 1/4W Resistors
R13 _____ 220R 1/4W Resistor

C1,C2 _____ 330nF 63V Polyester Capacitors
C3,C8 _____ 100 μ F 25V Electrolytic Capacitors
C4,C5 _____ 10pF 63V Ceramic Capacitors
C6,C7 _____ 4 μ 7 63V Electrolytic Capacitors

IC1 _____ TL062 Low current BIFET Dual Op-Amp

Circuit description:

The schematic of this circuit is drawn as a stereo unit to better show the input Main Fader and Pan-Pot connections. The TL062 chip contains two TL061 in the same 8 pin case and is wired as two virtual-earth mixer amplifiers having a voltage gain of about 4, to compensate for losses introduced in the passive Pan-Pot circuitry. Therefore, total voltage-gain is 1.

Each channel added to the mixer must include the following additional parts:
P1, P2, R1, R2, R3, R4, C1 and C2.

These parts must be wired as shown in the above circuit diagram, connecting R3 and R4 to pin #2 and pin #6 of IC1 for Right and Left channel respectively. These IC1 pins are the "virtual-earth mixing points" and can sum together a great number of channels.

Notes:

- Current drawing for one stereo Main Mixer Amplifier Module is 800 μ A.
- Frequency response is 20Hz to 20KHz - 0.5dB.
- Total Harmonic Distortion measured @ 2V RMS output = < 0.008% @ 1KHz;
< 0.017% @ 10KHz.
- THD is 0.005% @ 1V RMS output.
- Maximum undistorted output voltage: 2.8V RMS.

Further Parts:

To parts listed above should be added: one Main on-off SPST switch, a LED used as pilot-light with its dropping 2K2 1/4W series-resistor, DPDT switches to enable or omit Tone Control Modules as shown in the Block diagram, input and output connectors of the type preferred, one stereo dual-gang 100K potentiometer to fade the Stereo Line Input as shown in the Block diagram, battery clip, PP3 9V battery, knobs etc.