Microphone Preamp with adjustable bass response

Need a compact microphone preamplifier for your stereo amplifier or other equipment? Here is the ideal unit, a 2-transistor circuit on a printed board 2½ x 2⅛ inches. It has a voltage gain of 100 and a current drain of less than 0.5mA. The bass response may be adjusted to optimise speech clarity.

by LEO SIMPSON

Many uses can be found for this versatile microphone preamplifier circuit. It was developed to fill the requirements of a friend of the author and we decided the end result was so handy that many of our readers would want to build it. It would be just the thing for adding a microphone input to your stereogram for sing-along at parties. It can also be used in PA and guitar amplifers, in transmitters and tape recorders.

Later in the article we give details of modifications to the feedback loop to give variable bass roll-off. This improves the overload capability and clarity of reproduction for speech work.

A conventional circuit configuration is used. An NPN and PNP silicon transistor are connected together in a direct-coupled feedback-pair arrangement with both transistors operating as common-emitter amplifiers. Negative AC DC feedback is applied from the collector of the PNP transistor, Tr2, to the emitter of the NPN transistor, Tr1, via a 10K resistor. The ratio of the 10K resistor to the 100 ohm resistor in the emitter circuit of Tr1 sets the voltage gain of the circuit to 100.

Input impedance of the circuit is close to 50K, set by the parallel combination (to the input signal) of the bias resistors for Tr1. As such, it is suitable for dynamic microphones requiring a load of 50K. It can also be used to follow low output impedance FET pre-amplifiers for condenser microphones.

Microphones are connected to the circuit via shorting type jack socket, as shown in the circuit diagram. This shorts the input to the negative supply line when not in use so that residual noise is greatly reduced from what it would be if the input was left open-circuit.

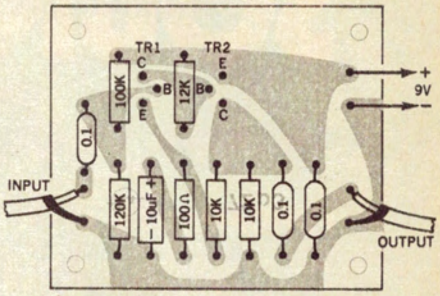
The output load for the preamplifier should be 20K or higher. Lower values will load the circuit excessively and increase distortion. The voltage gain may be reduced if necessary by increasing the value of the 100 ohm resistor. This will also have the effect of improving the distortion, overload margin and signal-to-noise ratio. Conversely, the gain may be increased by reducing the value of the 100 ohm resistor but the other performance parameters will be degraded.

As it stands, the circuit is intended for battery use. At a current drain of 450 microamps, an Eveready 216 9V battery will last a long time — approximately shelf life. But there is no reason why it should not be run from the supply rail of the amplifier or other equipment into which it is incorporated. Simply replace the 0.1uF supply bypass capacitor on the board with a 50uF / 12VW electrolytic type (higher voltage ratings may be used if size is not a problem) and calculate the required value of dropping resistor. Use the following formula:

$$R = \frac{(Vcc - 9V) \times 1000}{0.45}$$

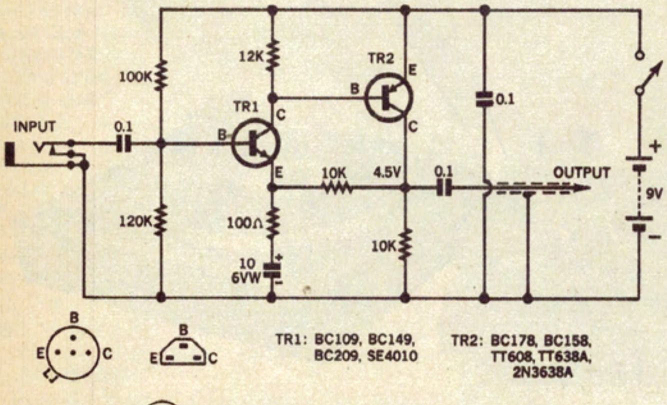
Vcc is the supply rail of the amplifier. For example, if the amplifier has a supply rail of 45V, the required resistor value is 82K (closest preferred value). If the amplifier was a valve type with HT rail of 300V, the nearest preferred value resistor is 680K. If two preamplifiers are to be used, the resistor value should be halved.

The printed board measures 2½ x 2⅛in and is easily assembled. Lockfit transistors may be used if desired.

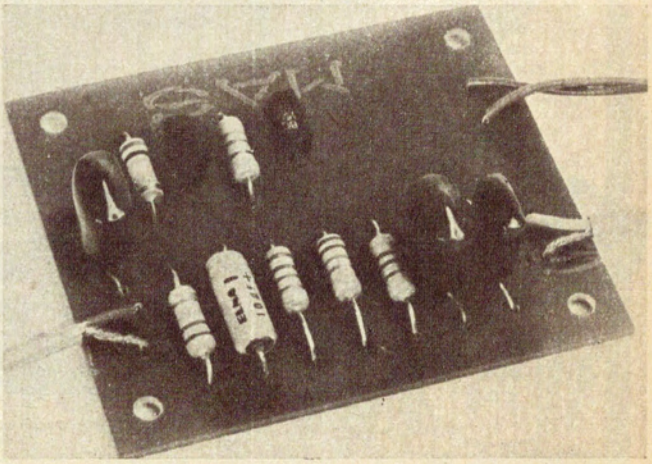


PARTS LIST

1 printed board, 2½ x 2⅛in (72/p2)
1 silicon NPN transistor, BC109, BC149, BC209 or SE4010
1 silicon PNP transistor, BC178, BC158, TT608, TT638A, 2N3638A
1 Eveready 216 or equivalent 9V battery
1 SPST switch
1 shorting jack socket
3 0.1uF/100VW metallised polyester capacitors
1 10uF/6VW electrolytic capacitor
RESISTORS
(½ or ¼ watt rating)
1 x 120K, 1 x 100K, 1 x 12K, 2 x 10K, 1 x 100 ohms.



MICROPHONE PREAMPLIFIER



Above is the basic circuit and at right is an assembled board.

Progress on Opera House Organ

Installation of the world's largest mechanical-action pipe organ is now well under way at Sydney's already famous Opera House.

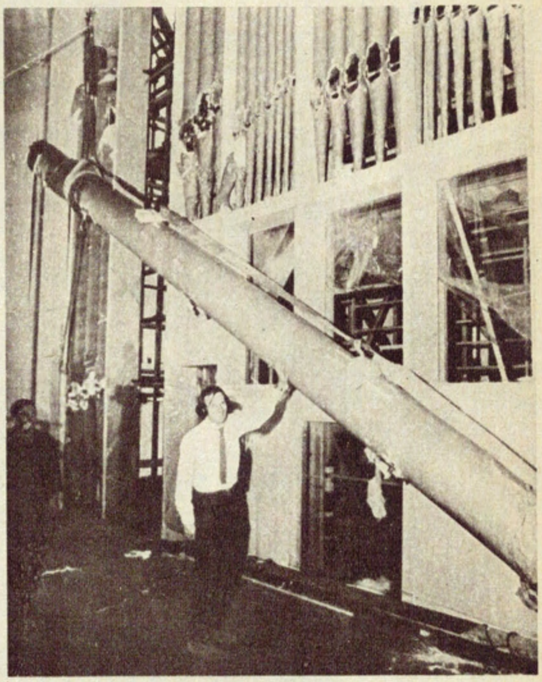
Although most of the pipes, the soundboards, the mechanism and the console have yet to be installed, the organ is already beginning to look very impressive. A glittering array of "show" pipes adorn the facade, making it strongly reminiscent of the classical 17th and 18th-century instruments.

The show pipes are of almost pure tin, and have been imported from Holland. They are classically proportioned diapason pipes, and form part of the organ's "32ft Principal" stop. The largest metal pipe in the stop is for EEEE, shown being installed at right. The four notes below this are blown by wooden pipes, which because of their great length have been placed at the rear of the organ.

When complete the Opera House Organ will possess more than 100 stops, including a second 32ft rank. There will be approximately 9,300 pipes, which is about 1,000 more than the mammoth organ in Sydney Town Hall. It is hoped that the organ will be playable when the Opera House is officially opened in 1973, but it may not be fully completed until 1974. Final cost is estimated at over $400,000.

The organ has been designed by Sydney designer and builder Ronald Sharp. Completely self-taught as an organ builder, Mr. Sharp has designed and built 15 pipe organs in the last 13 years, including the instrument at St. Mary's Cathedral in Sydney. General supervision of the installation is by Hall, Todd and Littlemore, the team of Australian architects given the job of completing the Opera House after Joern Utzon resigned in 1966.

Probably the most interesting feature of the organ is that it will employ direct mechanical or "tracker" action to link the keys of the console with the pallet valves responsible for admitting wind to the pipes. Tracker action offers considerably greater reliability than the pneumatic or electric action systems in favour with organ builders until recently. It also offers the facility for continuous "analog" control of pipe speech from the key, compared with the substantially "digital" or on-off control offered by pneumatic or electric action. For this reason many organists regard it as the "ideal" action. (J.R.)

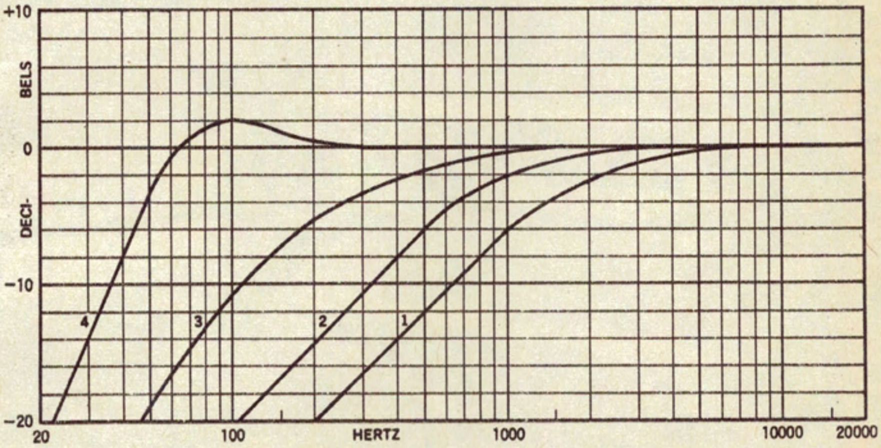


Designer-builder Ron Sharp supervising the installation of the largest of the front "show" pipes.

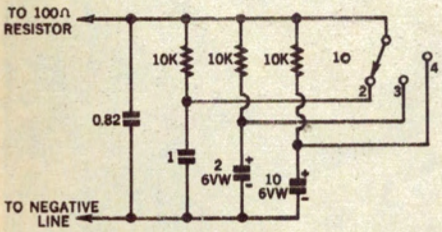
Microphone Preamp — continued

The preamp should be adequately shielded against hum and strong RF fields. If it is a self-contained unit with its own battery, it should be mounted in a metal case which is connected to the negative supply line. If the preamplifier is powered from an amplifier supply rail but is separately housed the DC return path could be via the shield of the output cable, if need be. This means that a figure-8 shielded cable or two wires with a common shield could be used instead of separate cables to the amplifer.

A modification can be made to the feedback loop to modify the bass response of the microphone. One of the problems encountered by "pop" singers is that the apparent bass response of a microphone changes depending on whether it is held very close to the mouth or further away. This has the effect of muddying the singer's voice when he is singing with a close mike. The problem is much reduced if the bass



Bass response curves for each of the feedback capacitor switch positions.



The optional switching circuit gives a choice of four bass response characteristics.

response of the preamplifier is rolled off below about 500Hz and this achieved by decreasing the size of the 10uF capacitor shown on the main circuit diagram.

Figure 2 is a switching arrangement of different capacitors which replace the single 10uF capacitor in the feedback loop. In the first position of the switch the feedback capacitor is 0.82uF and this corresponds to the maximum bass roll-off in the frequency response diagram, figure 3. The other three positions of the switch add capacitors in parallel to the 0.82uF to improve the bass response. Each frequency response plot corresponds to one of the switch positions.

Notice the 10K resistors associated with three of the capacitors on the switch bank. These maintain the capacitors at a DC potential equal to that across the 0.82uF capacitor and thus reduce switch clicks.

Two wires should be run from the feedback capacitor position on the board and the capacitors and resistors all mounted on the switch. Take care that the polarity of the electrolytic capacitors is correct.

Using the switch to modify the bass characteristic, the singer can choose the best position for good sound reproduction. With this arrangement, the threnody can be piercingly clear instead of muddy and distorted.