

A simple intercom

The perennially popular intercom — this circuit illustrates how to wring the maximum performance from the minimum number of components.

AN INTERCOM is an eminently *practical* device. Communication between rooms in a house is immensely aided by an intercom. The same goes for house and garage — or any other out-building.

The drawback with many intercoms is that that can be *too* effective. They shout at you. Whilst one can turn down the volume by one means or another, it's rather like using a sledge hammer to crack an acorn — as the saying goes. This intercom is simple, inexpensive and is ideally suited to quiet situations where volume is not all-important.

How it works

At first glance this circuit looks very simple, but its operation is quite ingenious as it performs different functions for transmit and receive.

To allow us to understand how it works, let's look at the receive mode first. When the pushbutton is not pressed the loudspeaker is connected across the line, in series with the battery. None of the remaining components are used in the receiver as they are isolated from the battery by the pushbutton. The battery voltage is connected across the line in series with the loudspeaker and is fed to the transmitter. Any change in current drawn by the transmitter will cause a movement of the cone of the loudspeaker. If a speech signal is fed down the line it will be heard in the remote speaker.

If you speak into the cone of a loudspeaker, the cone will vibrate in sympathy with the changing air pressure from the sound. The vibration of the cone moves the voice coil of the speaker which cuts the lines of force in the magnetic field of the speaker magnet. When a wire is moved through a magnetic field it generates a current in the



A small loudspeaker serves as both microphone and speaker in this intercom. Housing the project we have left up to you. It is quite possible to fit the components in a palm-sized box, such as one of the small 'zippy' boxes available inexpensively from a number of suppliers. The intercom may be powered from a 3 Vdc plugpack if you wish.

wire in sympathy with the movement. The loudspeaker can thus be used as a microphone, the speech signal output being taken from the voice coil as it converts the sound energy impinging on the cone to electrical energy in the voice coil.

In the transmit mode, the battery is isolated from the circuit by the depressed pushbutton and the supply voltage appears across the line from the

receive station. The signal from the loudspeaker passes through a capacitor, C2, which blocks the dc from the battery but allows the speech signal to pass to the base of Q3. The transistors Q2 and Q3 form a high gain pair which amplifies the speech signal and drives the output stage, Q1. The output transistor varies the amount of current drawn from the line in sympathy with the speech. Because this current moves

the cone in the receiver loudspeaker, the speech can be heard at the receiver.

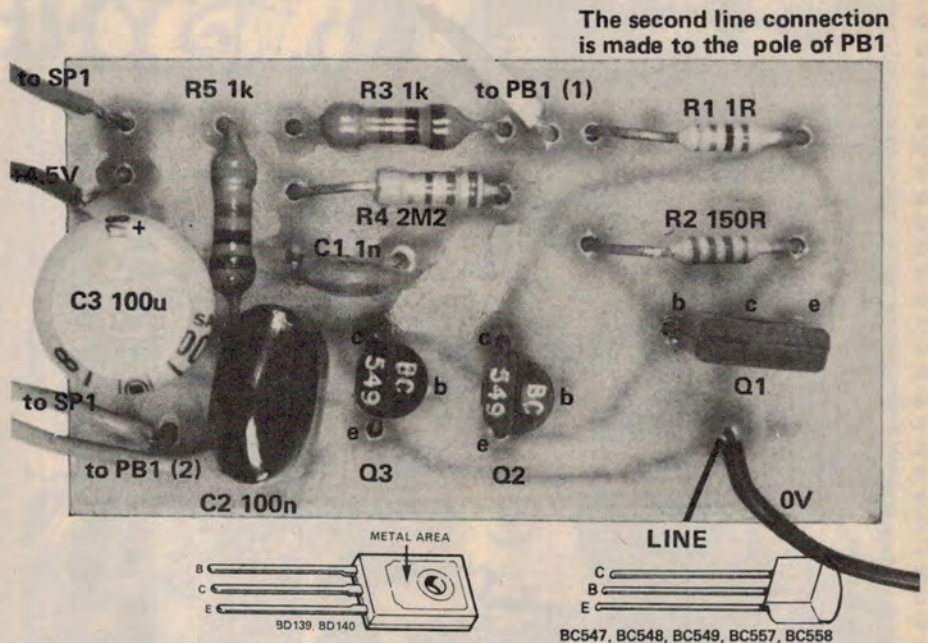
As the frequency spectrum of speech is mainly within the range 200 Hz to 3 kHz, the frequency response of the transmitter has been limited to about 3 kHz by placing a small capacitor across the base-collector junction of Q3. This causes a reduction in gain of that stage at high frequencies by introducing negative feedback which increases with frequency. Resistors R2, R3 and R4 set the bias on the stages and the one ohm resistor, R1, provides some emitter bias on the output stage as well as limiting the maximum output current.

The transmitters have been designed to work with supply voltages as low as 2½ volts. However, a 4½ volt supply allows for quite a high voltage drop in the line so that the intercom may work over quite a long line. We tried it over the length of the office (about 30 m) but some readers will, no doubt, have much greater distances in mind. For really long line lengths, the battery voltage could be increased to say, six volts.

Construction

We constructed one of our units on matrix board and the other on a pc board. Both methods work equally well, though constructing the matrix board version is a little more tedious and requires some care so that incorrect connections are not made. The orientation of the transistors is the only point to watch.

To power the intercom units, a standard 4½V battery may be used at



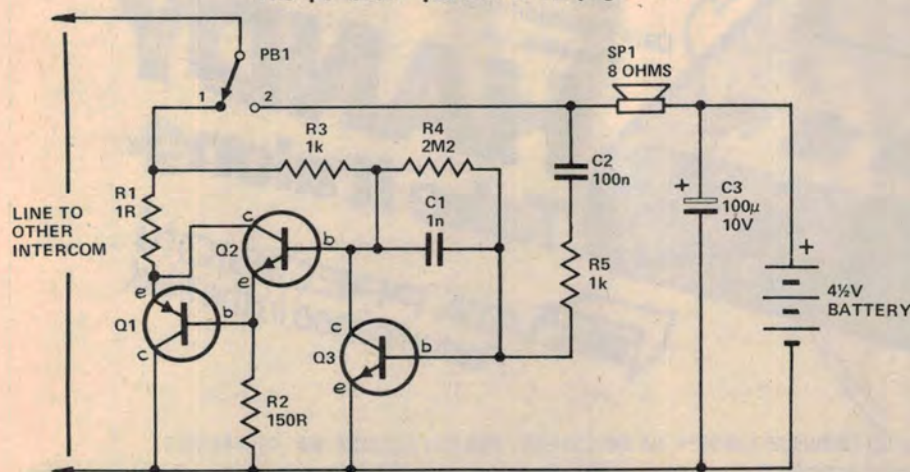
Overlay for the pc board. Take care with the orientation of the capacitor C3 and the transistors.



We assembled one unit on a piece of matrix board, laid out as shown.

each end. For longer battery life, three D-cells would be better, wired in series. If power is available, a 3 V plug-pack battery eliminator at each end should provide about four to five volts with the unit in operation.

The pc board pattern is on page 145.



PARTS LIST - ETI 262

Resistors all ½ W, 5%

R1 1R
R2 150R
R3 1k
R4 2M2
R5 1k

Capacitors

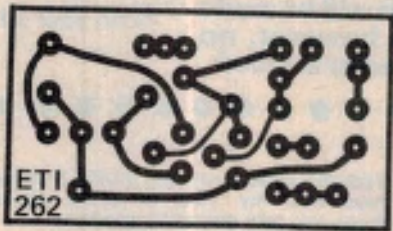
C1 1n
C2 100n
C3 100µ 10V electro

Semiconductors

Q1 BD140
Q2, Q3 BC549, BC109, DS549.

Miscellaneous

PB1 SPDT push button
SP1 eight ohm speaker
B1 4½ V battery or three 1½ V cells in series (with holders if required), ETI 262 pc board.



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