



ETI - 1537  
ELECTRONICS

# **Your own built-in phone conversation memory**

**There are many reasons people wish to record their phone calls. Be it posterity, security or even blackmail, ETI's Keith Brindley can show you how.**

**E**very now and again, it happens. You wish you had taken notes of that vital telephone conversation. Whoever you were talking to had said something of great importance but you can't remember it now. Or he made a verbal commitment to you which you know he'll never keep — and being only a verbal commitment, how can you hold him to it?

***'...bear in mind your telephone provider might not like you tampering with his equipment'***

The answer, of course, is to record the telephone conversation. Then you've got a record of the whole affair. However, short of dismantling your instrument (excuse the expression) and diving into the telephone's circuit, how do you do it?

A simple coil of wire is used in the ETI telephone recorder to pick up minute electromagnetic disturbances

corresponding to the audio tones passing to and fro along the telephone line. The interface circuit merely amplifies these audio tone disturbances to a level sufficient to be recorded by any typical cassette recorder.

Telephone pickup coils are, of course, available from many electronics outlets and any one of these can be used as a pickup for the ETI unit, but we give details here to make your own, out of common insulated copper wire. Our home-made version gives every bit as good results, too, as the more expensive purpose-made options.

## **Construction**

Building the unit is very simple but the usual procedures and precautions should be taken, depending on your chosen method.

The PCB component overlay is shown in Figure 2. The only precaution is to leave the transistors until last. This way, there is less likelihood of heat damage from a slap-happy soldering iron. Watch for electrolytic capacitor polarisation — make sure you get them the right way round.

The pickup coil is made by winding 150 turns of 30swg insulated copper wire onto a 25 mm former. Leave about 75 mm of wire at each end of the coil free. Neither the number of turns nor the former size are critical, so don't worry if you lose count or can't find a former which is exactly the right size. We used a bottle of Papermate typing correction fluid as our former (slightly over the size) and that proved adequate.

Similarly, the wire gauge isn't critical either — anything from about 25 to 35 swg wire will do. Once wound, slide the coil off its former and tie with string, lacing cord, wire or tape.

The ends of the coil now need to be connected to the circuit board and screened cable should be used for this. If you have used enamel-covered copper wire for the coil, you'll need to scratch off the last few millimetres of enamel from the ends of the coil, baring the copper, before they will accept solder. If you've used polyurethane coated copper wire, this is self-fluxing and can be

## The ring-in recorder

soldered direct. Whichever, solder earth and signal leads of the screened cable separately to the ends of the coil. It's best to insulate the connection, too, to prevent shorting. Heat-shrink sleeving is ideal for this but insulating tape provides a suitable alternative.

The length of screened cable between the coil and circuit board depends on your requirements but bear in mind that the longer this is, the more susceptible the project will be to interference. The circuit is basically a high-gain amplifier, and any small levels of interference will be amplified greatly, along with the signal. Our prototype has about 1.5 m of cable for this purpose and this seems to work without much interference at all.

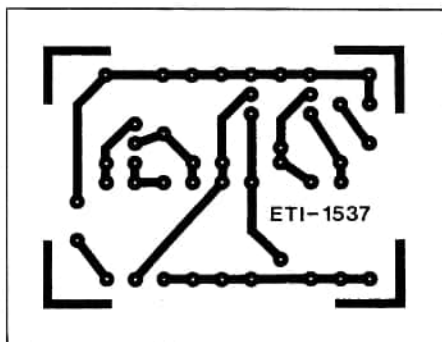
The output lead (the lead from circuit board to cassette recorder) on the other hand, can be much longer. The signal here has already been amplified and so is much less affected by interference.

We leave the housing up to you. As the project is a high-gain amplifier, a metal box earthed to the 0V battery line would be the best choice but is by no means essential. It all depends on where the circuit board is to be sited. If it's anywhere near a source of electromagnetic interference such as a mains power supply in a TV, computer or even your cassette recorder, the circuit may pick up the interference in the form of hum. If it's nowhere near such a source, you may get away with a plastic box.

Even though we give all this advice about reducing interference, it's worth noting that the pickup coil itself will pick up more interference than the screened cable and the circuit board, because that's what its purpose is! In this respect, the position of the phone is probably more important than cable and housing. If the phone is close to an interference source, the pickup is going to pick up interference, too.

### Setting up

The circuit itself requires no setting up but the coil may require some



## HOW IT WORKS

Figure 1 shows the circuit diagram for the telephone recorder. The pickup coil transforms any local electromagnetic radiations into signal voltages. It has a very low impedance and any amplifying circuit connected to it must consequently have a similar low impedance.

Positioned somewhere near the earpiece of the telephone instrument, the coil will pick up anything that would normally be heard by the user. Readers unfamiliar with telephone equipment may be forgiven for thinking that the sound heard in the earpiece consists of only the incoming part of the conversation — the voice of the person at the other end. However, all telephone instruments inject a certain amount of side tone into the earpiece circuit, which means a certain amount of the outgoing conversation is mixed with

the incoming one. The result is that the user can always hear his or her own voice as well as that of the other participant.

First stage amplification is provided by transistor Q1, connected in a common base amplifying mode. This presents the necessary low impedance to the pickup coil, acting merely as an impedance matcher (that is, a buffer) rather than a signal amplifier. Its output impedance is much higher than its input impedance, so any following stage of amplification can have a more usual higher input impedance.

Second and third stage amplification is provided by identical amplifiers based around transistors Q2 and Q3. These are connected in common emitter mode, together providing around 1000 times voltage amplification.

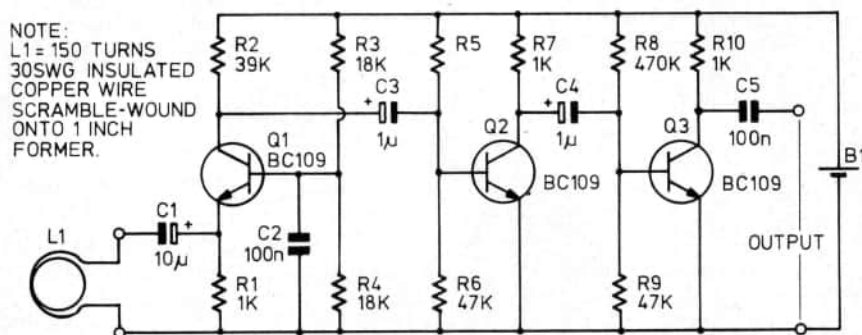


Figure 1: The circuit diagram of the telephone recorder.

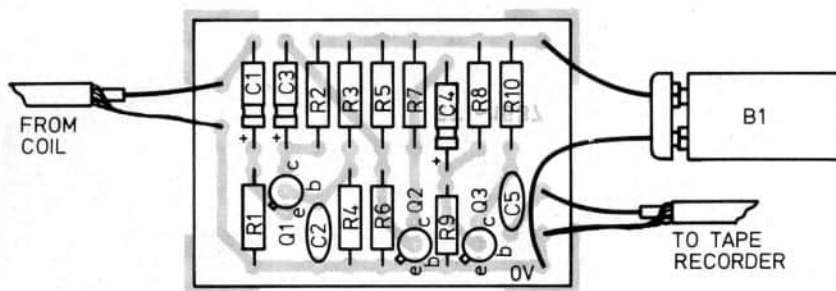


Figure 2: The PCB component overlay.

experimentation in positioning. Generally, the coil should be positioned somewhere near the earpiece of the phone — taped either to the back, or better still to the front, between earpiece and ear. Taped to the back the user won't feel the coil, but even between earpiece and ear the phone is still comfortable to use. Try different positions until you get the optimum.

If you really feel handy, you could mount the coil inside the handset of the phone, and fit a sub-miniature jack socket too, so that the phone is normally free of dangling wires. When you want to record a conversation, you only then need to plug in the screened lead to the circuit board and you're away. However, if you rent your phone from Telecom, bear in mind that they have a view on people drilling holes in their handsets.

It's worth mentioning here that some phones have an enclosed metal earpiece and the coil can't really pick up sufficient signal through the housing for the project to operate satisfactorily. However, all other modern phones we've tried have a plastic earpiece which gives superb results. If yours is a phone with such a metal earpiece, it's worth trying to experiment with the coil elsewhere, say around a line-matching transformer inside the main unit. You can but try.

Setting up your cassette recorder is totally up to you. Remember that the signals you are trying to record are audio, in particular, voice signals — well renowned for rapidly changing in amplitude. So, if your recorder is set too high, some parts of the conversation will be over-recorded and distorted. On the other hand, if the recorder is too low, some parts may not be recorded at all. Try playing around with the recorder setting, perhaps first dialling a 0055 service to give you a rough guide to incoming voice levels.

## PARTS LIST — ETI-1537

### Resistors (all 1/4 W 5%)

R1, 7, 10	1k0
R2	39k
R3, 4	18k
R5, 8	470k
R6, 9	47k

### CAPACITORS

C1	10 µ 16 V axial electrolytic
C2, 5	100n polyester
C3, 4	1 µ0 16 V axial electrolytic

### SEMICONDUCTORS

Q1, 2, 3	BC109
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### MISCELLANEOUS

B1	PP3 or similar 9 V battery
PCB or Stripboard	Screened lead. 30swg insulated copper wire. Case to suit.