

Meter measures current in uncut pcb track

This pcb ammeter measures a current I_1 flowing in a printed conductor without the track having to be broken. Figure 1

shows the principle of measurement. A pd across a short length of the conductor is presented to a trimmed V_{os} op amp. The op amp drives Tr2 and Tr1, causing a current I_2 to flow in the opposite direction to the current I_1 . Because the pd is seen as an

error, the negative feedback loop will pull it down to near zero. To achieve this, I_2 must be equal to the unknown I_1 . Current I_2 may be read from an ammeter. There are two basic problems with this circuit. Firstly a very low V_{os} op amp is required. This

will be important if the pd is only about $10 \mu\text{V}$. One answer is to make the probe in two parts, as shown in Fig. 2, to span the full length of the conductor. However, the minimum span of the probe should be from 10 to 15 mm. Suitable op amps are the Precision Monolithics OP-07 or OP-07A, which have a typical V_{os} of 30 and $10 \mu\text{V}$ and a typical stability of 300 and $200 \text{ nV}/^\circ\text{C}$ respectively.

The second problem is the power source. As current demand is equal to the unknown current, a lead-acid cell was chosen. The power for the op amp was provided by an inverter.

The led indicates when a reverse current has been applied. D1 to D4 with R2 and R3 protect the op amp; D5 and D6 protect Tr1.

Type BD461 was chosen for Tr1 because of its high gain at 1 to 2 A. This arrangement enables a high pd ammeter to be used on such a low supply voltage.

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Fig. 1: The basic circuit.
Fig. 2: Probe construction.
Fig. 3: Full ammeter circuit.

