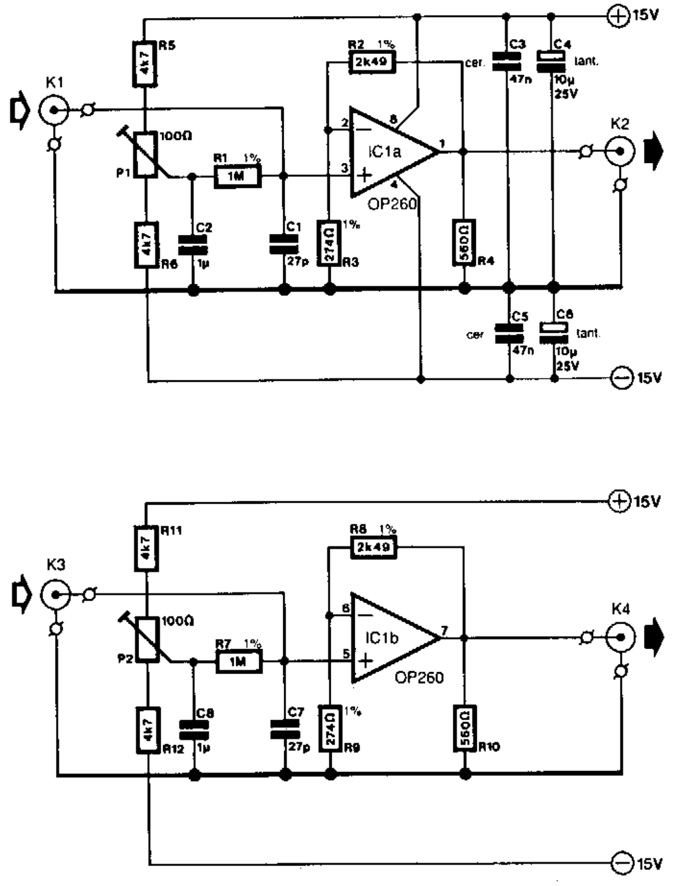
OSCILLOSCOPE PREAMP



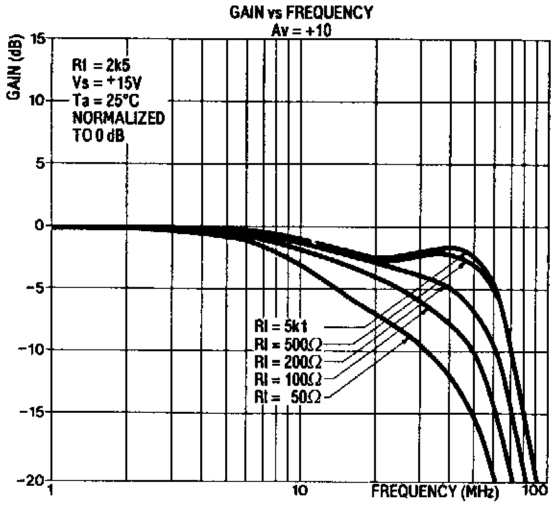
ELEKTOR ELECTRONICS

Fig. 39-1(a)

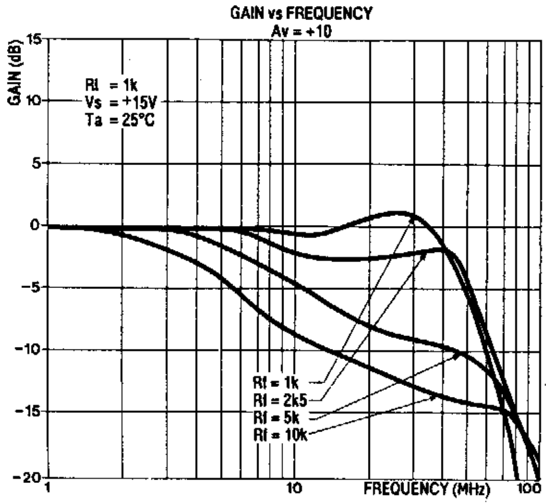
In many oscilloscopes, the most sensitive range is 2 to 5 mV, although it is often possible to improve this to 1 to 2 mV by a variable gain control. To obtain even better sensitivity, the present preamplifier, which has an amplification of about 10 (20 dB), might be useful.

Because most oscilloscopes have a bandwidth of 20 MHz or more, the amplifier must, of course, have a slightly wider bandwidth and that is achieved with a Type OP260 op amp. This has a slew rate of 550 V/μs (at an amplification of 10) and a bandwidth of 40 MHz that is virtually independent of the amplification. The gain vs. frequency response is not so good, however: as can be seen from Fig. 39-1(b), where the characteristics are given for a number of loads. The hump in the curves depends on the value of the feedback resistor, whose optimum value appears to be 2.5 kΩ.

The curves in Fig. 39-1(c) accord with different values of R_2/R_8 for an amplification factor of 10. Some experimentation with the value of R_2/R_8 for different amplification factors can be instructive. Remember, however, that the output impedance increases from 20 to 225 Ω over the frequency range of 10 MHz to 60 – 70 MHz. It is therefore important to keep all connections on the prototyping board as short as possi-



ELEKTOR ELECTRONICS *Fig. 39-1(b)*



ELEKTOR ELECTRONICS *Fig. 39-1(c)*

ble and to connect all earth points to a common ground via a separate, heavy track. Also, do not use an IC socket.

An input impedance of 1 MΩ was chosen, which results in a fairly high level of noise at the output (with open-circuit input). This value can be reduced, because otherwise the use of a 1:10 probe will be inhibited; it would give constant problems with the noise. However, when the amplifier is connected to a suitable source, the noise reduction is normally more than ample to obtain a good trace on the screen. Presets P1 and P2 provide compensation for the dc offset and input offset, caused by R1 and R7 respectively.

The input bias current for the noninverting input is about 10 times lower than that for the inverting input, which makes the OP260 more suitable for noninverting circuits. The inverting circuit can also give problems because of the low values of R_2 (R_8) and R_3 (R_9). The input bias current is typically 0.2 μA, and the input offset is about 3 mV (max. 7 mV).

In this type of circuit, it is important to use a well-regulated power supply. The power-supply suppression up to 10 kHz is roughly 70 dB, and this reduces with increasing frequency. Any noise or tiny ripple on the supply lines would make the application of the circuit as a small-signal amplifier impossible.

The circuit draws a current of about 14 mA. The slew rate, as with most op amps, is asymmetric and might lead to visible distortion of the signal when the drive to the 560-Ω resistor is high at the higher frequencies.