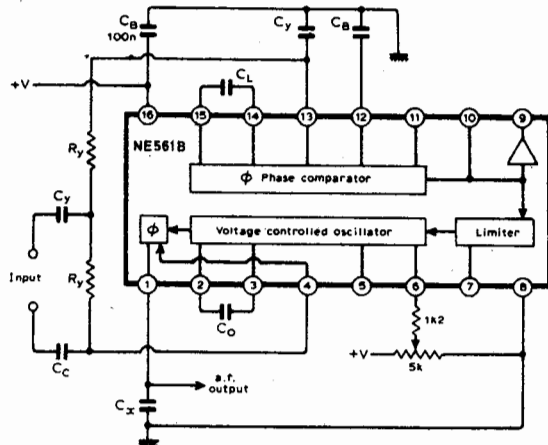


# tech-tips

## PLL AM RECEIVER



It is possible to construct a simple a.m. receiver using a single off-the-shelf phase-locked-loop integrated circuit, together with a few external components. A major advantage of this approach is that no tuning coils are needed. Sensitivity can be improved with the addition of a wide-band r.f. amplifier front end, but it is important that the input of the phase-locked-loop should not exceed 0.5V r.m.s.

In the circuit the phase-locked-loop is locked to the incoming amplitude modulated carrier and the voltage controlled oscillator signal. The amplitude of the demodulated signal at the output is a function of the phase relationship between the carrier and the local oscillator, being a minimum when the two are in quadrature and a maximum when either an in-phase or 180° degree out-of-phase condition exists. As the phase-locked-loop will always lock onto the input signal with a constant 90° phase error, it is necessary to add a 90° phase shift to compensate (CyRy).

For a receiver intended for use in the medium wave band from 550kHz to 1.6MHz, the 90° phase shift is set to be correct at the geometric mean of the frequency limits (=0.94MHz). Assuming a value of 3kΩ for R<sub>y</sub>, C<sub>y</sub> is then:

$$C_y = \frac{1.3 \times 10^{-4}}{0.94 \times 10^6} = 135\text{pF}$$

The low-pass filter for the loop, C<sub>L</sub>, is non-critical in this application since no information is being derived from the loop error. It is only necessary to ensure loop stability. A value of 10nF was found to be perfectly satisfactory for this component.

Tuning is accomplished by setting the voltage controlled oscillator frequency to the frequency to be received. Ignoring the tuning potentiometer for a moment, the voltage controlled oscillator frequency is set by C<sub>0</sub> and is determined by the formula:

$$C_0 = \frac{300\text{pF}}{f_0}$$

where f<sub>0</sub> is in MHz.

Fine tuning can be achieved by varying the amount of current flowing into or out of pin 6. When this current is zero - corresponding to the potentiometer being set in the centre of its travel - the voltage controlled oscillator frequency is determined by C<sub>0</sub>. A value of 330pF will set the frequency close to 0.94MHz, which is the centre of the required tuning range. The resistor in series with the potentiometer wiper is selected to provide the

desired tuning range - about 1.2kΩ when an 18V power supply is employed.

Capacitor C<sub>x</sub> is intended to roll-off the audio output to provide the desired bandwidth and should be calculated on the basis of an output resistance of 8kΩ. Obviously the load resistance must also be taken into account for this calculation.

The receiver requires a good earth, as mentioned earlier, sensitivity is improved by a wide-band r.f. amplifier.

Submitted by SDS Components Ltd, Halsea Trading Estate, Portsmouth who can supply the NE 861B from stock.