PHASE LOCKED LOOP EASES FREQUENCY MEASUREMENTS

Using a low cost frequency counter to measure low audio frequencies can try your patience. To get .1 Hz resolution takes 10 seconds per reading. Sometimes the front end of the counter won't even respond to the frequency you are trying to measure. The following circuit can be used to multiply the input frequency by 10 or 100 so that your counter (and you) will have an easier time of it.

The 4046 CMOS PLL does most of the work. Using phase comparator #2 guarantees that the loop will not lock on a harmonic of the input frequency. The dividers determine the multiplication ratio. One thing to note, while you can change the dividers to get other ranges, you may need to add an amplifier and change the low pass filter to make it stable again. This is because the loop gain is reduced by the divide ratio. The filter shown will track below 20 Hz frequency input in either X10 or X100 range.

The LED lights to indicate out of lock. It generally works, but, if the input frequency is too low, there is a range where the circuit is not locked but the LED isn't lit. This is obvious when looking at the frequency counter because the display jumps around. Since this only happens below 20 Hz, you are usually immediately aware of what is happening. The LED will tell you when the input frequency is too high (the counter also indicates the overrange frequency of approximately 27 KHz.).

The input circuit allows use with low amplitude sine waves (0.1 VRMS sensitivity). Hysteresis is included for noise immunity. Often input overload protection would be provided by a diode to each supply rail. This will NOT work here. While the diodes will protect the amplifier, they will give a double frequency reading! During the part of the cycle where the input goes above the common mode voltage range (V+ -2.6V), the output jumps to the positive rail. With an inverting configuration, this happens when the output was negative. The jump to rail and then recovery looks to the PLL as another input cycle. A transistor is used to clamp minus inputs because the reference source resistor is too large to work with a diode.