Nuts & Bolts

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In preparing to perform the extensive series of tests on cassette wow and flutter that appear elsewhere in this issue, we were faced with a problem: we did not have a readily available wow and flutter meter. We were quoted something like $300 a month to rent such an instrument, so we decided to build one ourselves. Fortunately, a wow and flutter meter can be simple and inexpensive. The schematic of our unit is shown below.

The heart of the meter is a Signetics phase locked loop (PLL) Chip, the NE565. A phase locked loop is basically a negative feedback system that compares the reference frequency (in this case a 3 kHz tone played back from the tape recorder) to the frequency generated by its own internal voltage controlled oscillator (VCO). If the two are reasonably close together in frequency, the action of the PLL is to synchronize the two frequencies.

Synchronism is maintained by an "error signal" inside the phase locked loop. As the 3 kHz tone from the tape varies in frequency, due to variations in the speed of the tape recorder, the error signal will vary to cause the internally generated 3 kHz tone to track. The error signal may then be used as an indicator of frequency variation in the tape recorder speed, in other words, the wow and flutter component.

The phase locked loop is largely immune to variations in the amplitude of the tone from the tape, and it's capable of acquiring lock even when the incoming tone and the internal VCO are quite different in frequency.

To calibrate the wow and flutter meter, a 3 kHz tone is fed directly into the meter. This is varied by some known amount (a digital frequency counter is handy here) and the corresponding change in error voltage measured.

In the circuit shown, the blocking capacitor C1 removes a large DC component from the error voltage signal, passing signals above about 0.5 Hz. The CA3140 op amp (IC1) buffers this network and supplies the outside world with the error signal at a low impedance level. As it stands, the error signal, due to wow and flutter signals, is quite small: in the region of 5 millivolts for a typical tape deck. IC1 could be wired as an amplifier if the monitoring device needs a larger signal.

The error signal also contains a certain amount of 6 kHz frequency; the op amp low pass filter circuit (IC2) removes this residual signal. The wow and flutter waveform is monitored on an oscilloscope, the cutoff frequency of the low pass filter being reduced by adjustment R2 until the 6 kHz is seen to disappear. ■