Using the Loop Test Board

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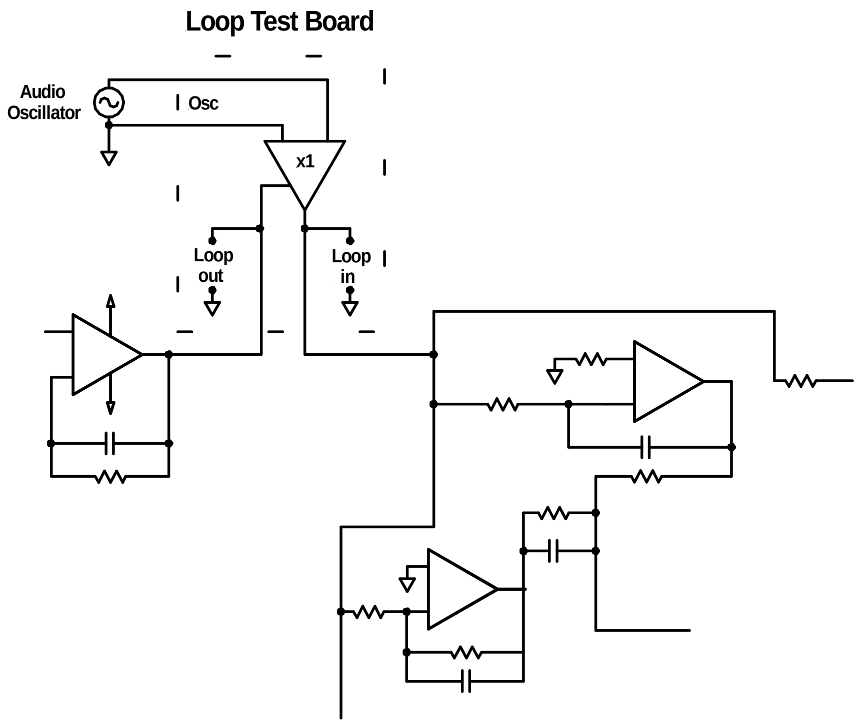
The board is designed to accept different styles of signal connectors as desired by the builder. Provisions are made for BNC connections, miniature terminal strips and test points suitable for scope probes. The Test Board parts are listed near the bottom of the FBV parts list.

In addition to the Test Board, a cable is needed to connect it to the Electronics Board of the seismometer under test. The cable has identical 5-pin Molex connectors on both ends, pin 1 connected to pin 1, 2 to 2, etc. It both provides power to the test board and connects the test signals to the Electronics Board. To measure loop performance, the jumper connecting pins 1 and 2 of JP2 of the Electronics Board should be removed and the Test Board connected by means of the cable.



A sine wave signal source is connected to the *Osc* pins and an oscilloscope, meter or, for low frequencies, A/D inputs, are connected to the *Loop Out* and *Loop In* terminals.

The most useful measurements will be made near the gain-crossover frequency, the frequency at which V_{out} and V_{in} become the same. So you might want to start with the oscillator set to around 30 Hz. Gradually increase the signal level until there are good, easily measurable sine waves at *Loop In* and *Loop Out*. If either signal becomes distorted, possibly exhibiting a tall spike at the peak, reduce the oscillator voltage until both sine waves are clean.

The loop gain at the test frequency is given by V_{out} / V_{in}. And the frequency at which $V_{out} = V_{in}$ will be the gain crossover frequency.

The loop phase may be computed from the values of V_{osc}, V_{out} and V_{in}.

Loop Phase = $\cos^{-1} [(V_{out}^2 + V_{in}^2 - V_{osc}^2)/(2\ V_{out} V_{in})] - 180$ deg.

At gain crossover where $V_{out} = V_{in} \equiv V$, the loop phase will be $\cos^{-1}(1- (V_{osc}^2/2V^2)) -180$ degrees, and the phase margin, which is the difference between the loop phase and -180 degrees, is just $\cos^{-1}(1- (V_{osc}/2V^2))$. The phase margin should be greater than 40 degrees in order to avoid too large a response peak at the gain crossover frequency and the possibility that the loop might start to oscillate as a result of moderate circuit parameter changes.

For additional information, a log-log plot of Loop Gain vs frequency will tell much about how the loop is performing.