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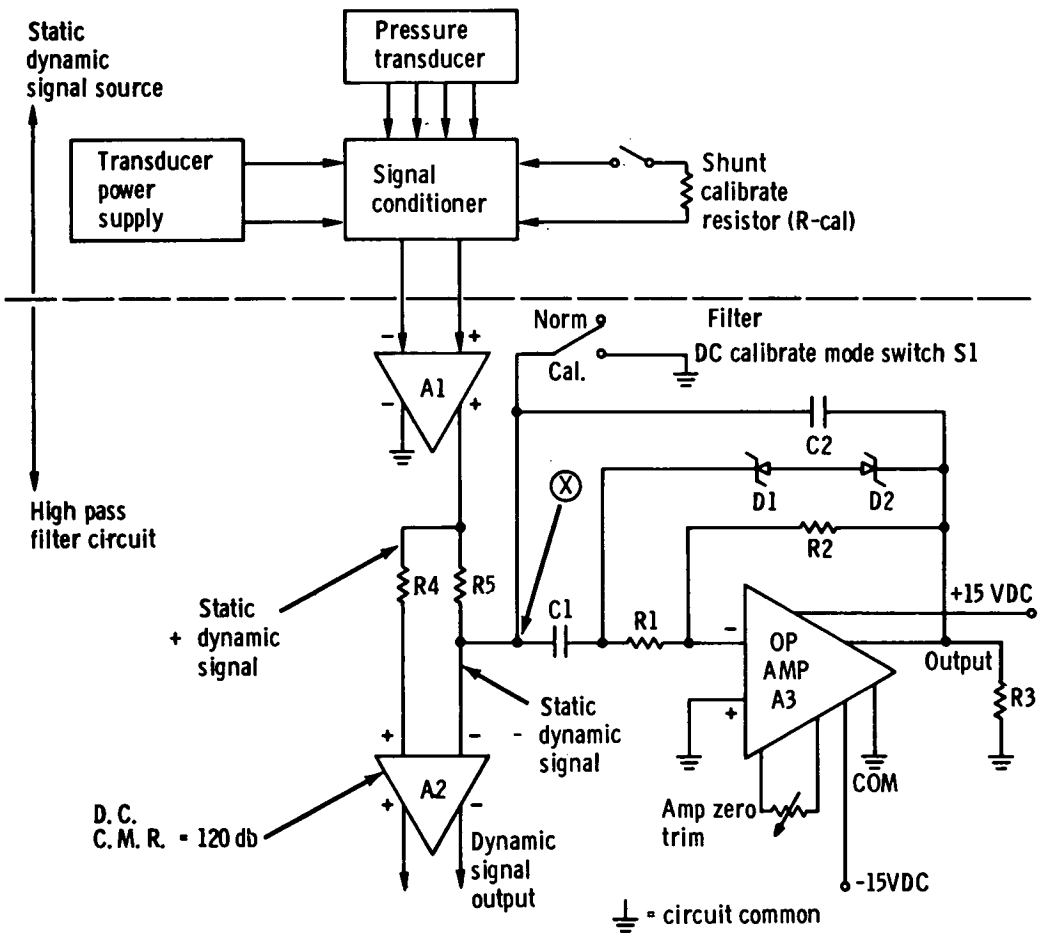
Electronic High Pass Filter



An ultra accurate electronic high pass filter has been designed and developed for use with static type pressure transducers where it is desirable to extract low frequency dynamic signals from the combined static and dynamic signal. The system can be calibrated at any time with DC voltages.

The filter as well as the complete measuring or recording system can be switched at any time to the calibrate mode where DC voltages at the input and output of the system can be measured and the amplifier gains adjusted to produce the desired transfer function. Accurate DC voltage measurements can be easily obtained by a digital voltmeter. The resultant DC transfer function is exactly equivalent to the peak amplitude of the AC transfer function of the filter just above and beyond its roll off frequency. This feature permits the calibration of the system just prior to its use.

In the schematic, the upper section shows the signal source and the lower section shows the DC calibrateable

(continued overleaf)

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high pass filter circuit elements. The signal source is shown as a typical example of one containing combined static and dynamic voltages. This signal is connected to the input of amplifier A1. One side of amplifier A1 output is connected to circuit common, the (+) output connects to amplifier A2 input through R4 and R5.

The 120 db common mode rejection of DC capability of A2 will not allow DC signals to pass through A2. When switch S1 is placed in the calibrate position, amplifier A2 will convert to a DC transfer function amplifier and allow both A1 and A2 to be adjusted to a desired gain by measuring the DC voltage at the A2 output when the signal conditioner "R-Cal" resistor is switched in the transducer bridge to produce an exact pressure equivalent voltage. The high pass filtering process starts when S1 is placed in the open or normal position. Operational amplifier A3 gain is determined by the values of R1 and R2. The first and conventional DC summing junction occurs at A3 negative input terminal. Capacitor C1 blocks DC from the amplifier's input and makes A3 responsive only to AC signals. A second summing function provided by feedback capacitor C2 and resistor R5 for AC signals occurs at point (X). The low frequency response of A3 is controlled by the value of C1, where an increase in capacity lowers the frequency response. The value of C1 is thus selected to determine the high pass frequency point where no signal attenuation occurs. Zener diodes D1 and D2 provide a discharge path for C1 at high input voltage conditions that would lock up A3. Amplifier A3 reacts to high pass frequencies by creating a summing junction at circuit point (X) in a manner that keeps point (X) at zero volts AC. This has the effect of placing the negative input of A2 at circuit common and allows A2 to transfer AC voltages to its output.

In this circuit, the filtering action begins to attenuate frequencies below five Hz and achieves a maximum attenuation of 120 db at DC conditions. The attenuation frequency break point is primarily determined by the capacitance of C1. The gain of A3 and the value of C2 affects the zero voltage summing ability of junction (X). This sets a limitation on the clamping of the AC amplitude of the signal from the output of A1.

Notes:

1. The filter circuit affords its greatest service in its ability to operate as a high pass filter at the very low frequency end of the AC spectrum when compared to other filter circuits. It further excels in the method of filtering wherein the signals that pass through the system do not directly route through any frequency selective filter element where amplitude and phase distortion over a wide frequency range would degrade the measurement.
2. The filter system can be used for any application where accurate amplitude measurements of wave forms above a selected frequency are desired. Amplifiers A1 and A2 can be integrated circuit operational amplifiers where size reduction is important.
3. No additional documentation is available. Specific technical questions, however, may be directed to:
   Technology Utilization Officer
   Lewis Research Center
   21000 Brookpark Road
   Cleveland, Ohio 44135
   Reference: B74-10083

Patent Status:

Inquiries concerning rights for the commercial use of this invention should be addressed to:

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