OP AMP APPLICATIONS

As a result of the high ratio of differential to CM gain in A1-A2, CMR of this in-amp theoretically increases in proportion to gain. Large common mode signals (within the A1-A2 op amp headroom limits) may be handled at all gains. Finally, because of the symmetry of this configuration, common mode errors in the input amplifiers, if they track, tend to be canceled out by the subtractor output stage. These features explain the popularity of this three op amp in-amp configuration—it is capable of delivering the highest performance.

The classic three op amp configuration has been used in a number of monolithic IC in-amps (see References 8 and 9). Besides offering excellent matching between the three internal op amps, thin film laser trimmed resistors provide excellent ratio matching and gain accuracy at much lower cost than using discrete precision op amps and resistor networks. The AD620 (see Reference 10) is an excellent example of monolithic IC in-amp technology. A simplified device schematic is shown in Figure 2-13 below.

![Schematic diagram of AD620 in-amp](image)

**Figure 2-13: The AD620 in-amp simplified schematic**

The AD620 is a highly popular in-amp and is specified for power supply voltages from ±2.3V to ±18V. Input voltage noise is only 9nV/√Hz @ 1kHz. Maximum input bias current is only 1nA, due to the use of superbeta transistors for Q1-Q2.

Overvoltage protection is provided by the internal 400Ω thin-film current-limit resistors in conjunction with the diodes connected from the emitter-to-base of Q1 and Q2. The gain G is set with a single external RG resistor, as noted by equation 2-4 below.

\[ G = \left( \frac{49.4k\Omega}{R_G} \right) + 1 \]  

**Eq. 2-4**

As can be noted from this expression and Fig. 2-13, the AD620 internal resistors are trimmed so that standard 1% or 0.1% resistors can be used to set gain to popular values.

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