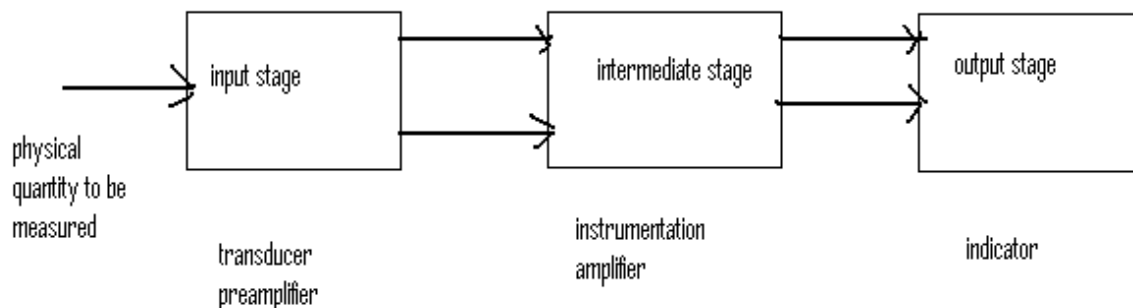


Instrumentation Amplifier

Generally, a transducer is used at the measuring site to obtain the required information easily and safely. The transducer is a device that converts one form of energy to another. To amplify the low level output signal of transducer so that it can drive the indicator is major function of Instrumentation amplifier.

Block diagram of instrumentation system



An **instrumentation** (or **instrumentation**) **amplifier** is a type of differential amplifier that has been outfitted with input buffers, which eliminate the need for input impedance matching and thus make the amplifier particularly suitable for use in measurement and test equipment. Additional characteristics include very low DC offset, low drift, low noise, very high open-loop gain, very high common-mode rejection ratio, and very high input impedances. Instrumentation amplifiers are used where great accuracy and stability of the circuit both short- and long-term are required.

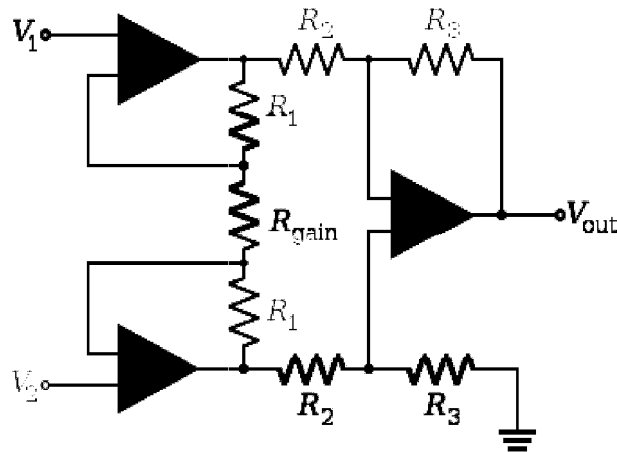


Figure 2.1

Although the instrumentation amplifier is usually shown schematically identical to a standard op-amp, the electronic instrumentation amp is almost always internally composed of 3 op-amps. These are arranged so that there is one op-amp to buffer each input (+,-), and one to produce the desired output with adequate impedance matching for the function.^{[1][2]}

The most commonly used instrumentation amplifier circuit is shown in the figure. The gain of the circuit is

$$\frac{V_{\text{out}}}{V_2 - V_1} = \left(1 + \frac{2R_1}{R_{\text{gain}}}\right) \frac{R_3}{R_2}$$

The rightmost amplifier, along with the resistors labelled R_2 and R_3 is just the standard differential amplifier circuit, with gain = R_3 / R_2 and differential input resistance = $2 \cdot R_2$. The two amplifiers on the left are the buffers. With R_{gain} removed (open circuited), they are simple unity gain buffers; the circuit will work in that state, with gain simply equal to R_3 / R_2 and high input impedance because of the buffers.