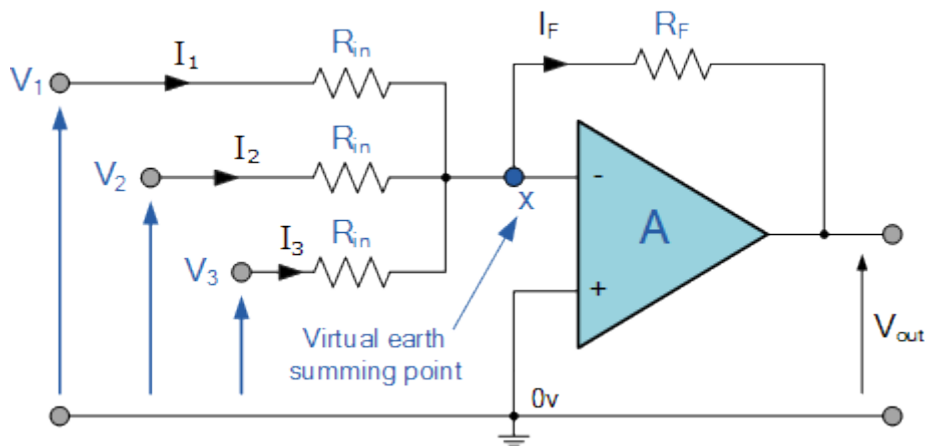


SUMMER

We know that the inverting operational amplifier that the inverting amplifier has a single input voltage, (V_{in}) applied to the inverting input terminal. If we add more input resistors to the input, each equal in value to the original input resistor, (R_{in}) we end up with another operational amplifier circuit called a **Summing Amplifier**, “*summing inverter*” or even a “*voltage adder*” circuit as shown below.

Summing Amplifier Circuit



In this simple summing amplifier circuit, the output voltage, (V_{out}) now becomes proportional to the sum of the input voltages, V_1 , V_2 , V_3 , etc. Then we can modify the original equation for the inverting amplifier to take account of these new inputs thus:

$$I_F = I_1 + I_2 + I_3 = - \left[\frac{V_1}{R_{in}} + \frac{V_2}{R_{in}} + \frac{V_3}{R_{in}} \right]$$

$$\text{Inverting Equation: } V_{out} = - \frac{R_f}{R_{in}} \times V_{in}$$

$$\text{then, } -V_{out} = \left[\frac{R_F}{R_{in}} V_1 + \frac{R_F}{R_{in}} V_2 + \frac{R_F}{R_{in}} V_3 \right]$$

However, if all the input impedances, (R_{IN}) are equal in value, we can simplify the above equation to give an output voltage of:

Summing Amplifier Equation

$$-V_{out} = \frac{R_F}{R_{IN}} (V_1 + V_2 + V_3 \dots \text{etc})$$

We now have an operational amplifier circuit that will amplify each individual input voltage and produce an output voltage signal that is proportional to the algebraic “SUM” of the three individual input voltages V_1 , V_2 and V_3 . We can also add more inputs if required as each individual input “sees” their respective resistance, R_{in} as the only input impedance.

This is because the input signals are effectively isolated from each other by the “virtual earth” node at the inverting input of the op-amp. A direct voltage addition can also be obtained when all the resistances are of equal value and R_f is equal to R_{in} .

Note that when the summing point is connected to the inverting input of the op-amp the circuit will produce the negative sum of any number of input voltages. Likewise, when the summing point is connected to the non-inverting input of the op-amp, it will produce the positive sum of the input voltages.