INSTRUCTION MANUAL
FOR
APPLICATIONS OF OPERATIONAL AMPLIFIER KIT

Operational Amplifier Circuits has been designed to study the following :-

1. Operational amplifier as Inverting Amplifier.
2. Operational amplifier as Non-Inverting Amplifier.
3. Operational amplifier as Summing Amplifier.
4. Operational amplifier as Difference Amplifier.
5. Operational amplifier as Differentiator.
6. Operational amplifier as Integrator.
7. Operational amplifier as Sine Wave Generator.
8. Operational amplifier as Sine to Square Wave Convertor.
9. Operational amplifier as Square to Triangular Wave Convertor.
10. Operational amplifier as Unity Gain Amplifier.

THEORY

The operational amplifier is a versatile device that can be used to amplify dc as well as ac input signals and was originally designed for computing such mathematical functions as addition, substraction, multiplication, and integration. With the addition of suitable external feedback components, the modern day op-amp can be used for a variety of applications, such as ac and dc signal amplification, active filters, oscillators, comparators, regulators, and others.

An Ideal op-amp exhibit the following electrical characteristics :

1. Infinite voltage gain A.

2. Infinite input resistance R_i so that almost any signal source can drive it, and there is no loading of the preceding stage.

3. Zero output resistance R0 so that output can drive an infinite number of other devices.

4. Zero output voltage when output voltage is zero.

5. Infinite bandwidth so that any frequency signal from 0 to Hz can be amplified without attentation.

Infinite common-mode rejection ratio so that the output common-mode noise voltage is zero.

Infinite slew rate so that output voltage changes occur simultaneously with input voltage changes.

PROCEDURE

E : **V+ (+15V) & V- (-15V) power supplies are already connected internally. Only you have to connect the circuit through patchchords.**

perational amplifier as Inverting Amplifier:-

Connect the circuit as shown in fig. no. (1).

Use R_1 (1KΩ) in the input circuit and RF (10KΩ)) in the feed back circuit.

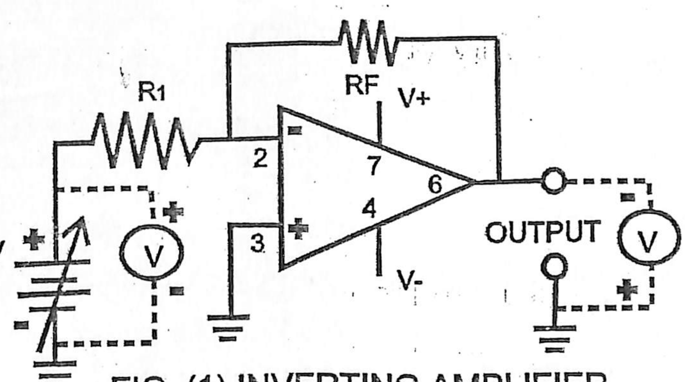

FIG. (1) INVERTING AMPLIFIER

Set the input voltage (V_{IN}) at 0.5V.

Note down the output using DC voltmeter.

Repeat steps 2 - 4 for different input voltages. (0.75Volt and 1Volts).

ıula for calculation of output voltage:-

$$V_{OUT} = -V_{IN} [RF / R_1]$$

Operational amplifier as Non Inverting Amplifier :-

Connect the circuit as shown in fig. no. (2).

Select R_1 in the input circuit and RF in the feedback circuit. (R_1 = 1KΩ, RF = 10KΩ)

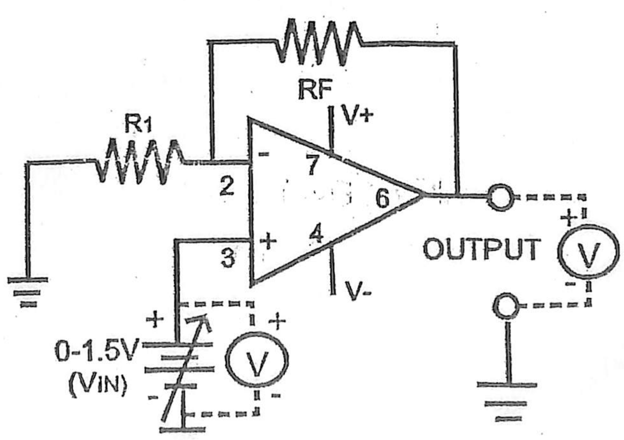

FIG. (2) NON-INVERTING AMPLIFIER

Set the input voltage (V_{in}) at 0.5V

Note down the output using DC Voltmeter.

Repeat steps 2-4 for different input voltages. (0.75V and 1Volt).

rmula for calculation of output voltage:-

$$V_{OUT} = V_{IN} [1 + RF / R_1]$$

Operational amplifier as Summing Amplifier (as Adder) :-

Connect the circuit as shown in fig. no. (3).

Apply input voltages of 1V from both the supplies. Also choose R_1 and R_2 in the input circuit as both are equal to 10kΩ.

Note down the output voltage.

Repeat steps 2 & 3 for different input voltages keeping R_1 & R_2 as it is.

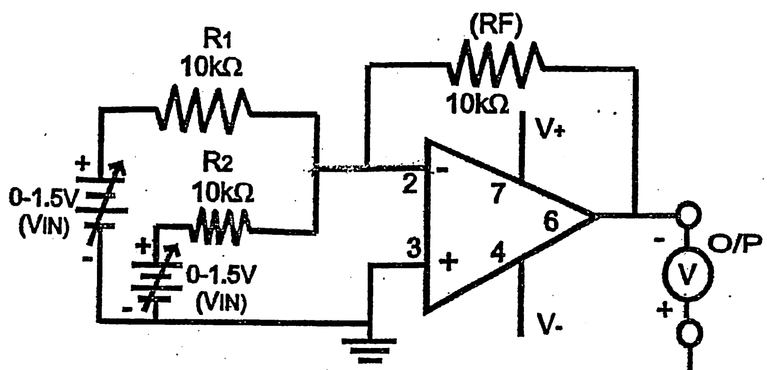

FIG (3) SUMMING AMPLIFIER

Calculate the output voltage using formula:-

$$V\,out = -[V_{IN} (RF / R_1) + Vin (RF / R_2)]$$

Operational amplifier as Difference Amplifier (As Subtractor) :-

Connect the circuit as shown in fig. no. (4).

Apply input voltage of 0.5V at pin no. 2 and 1.5V at pin no. 3 from both the supplies. Also choose R_1 and R_2 in the input circuit as both are equal to 10kΩ.

Note down the output voltage.

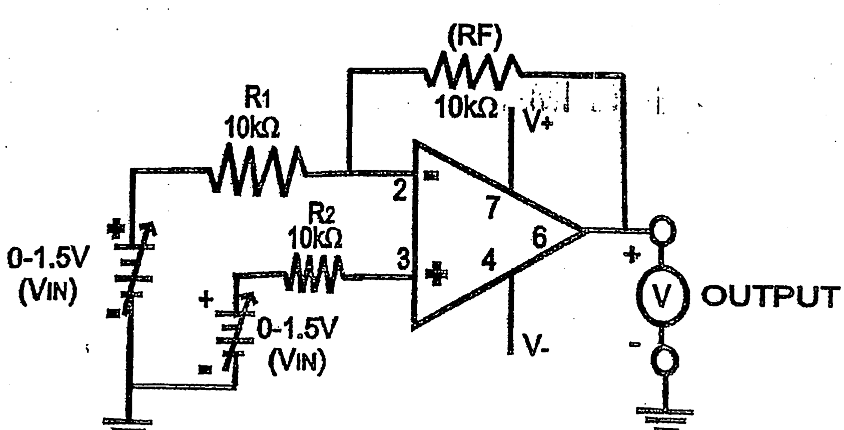

FIG. (4) DIFFERENCE AMPLIFIER

Repeat steps 2 & 3 for different input voltages keeping R & R as it is .

Calculate the output voltage using formula:-

$$V_{out} = V_{in} (1 + RF/R_2) - V_{in} (RF/R_1)$$

E : Always apply higher voltage at pin no. 3 as compare to pin no. 2.

perational Amplifier as Differentiator Circuit:-

Connect the circuit as shown in fig. no. (5).

Use capacitor C1 (0.1uf) in the input circuit and RF (10kΩ) in the feed back circuit.

Connect Audio Frequency Function Generator across input of the circuit & CRO across output.

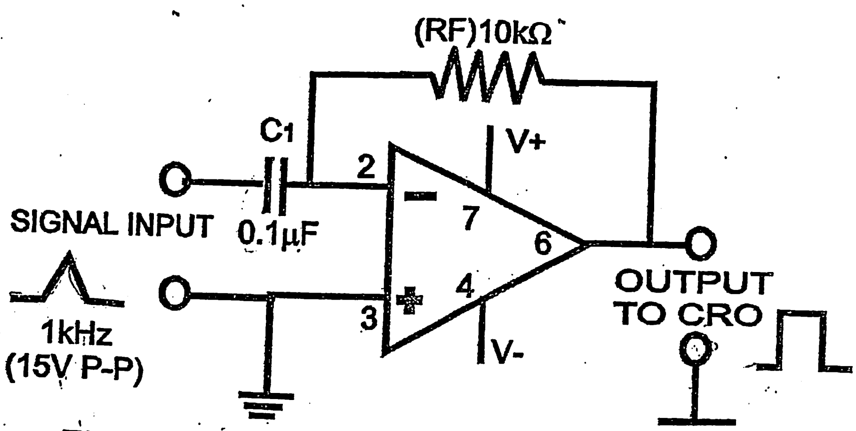

FIG (5) DIFFERENTIATOR CIRCUIT

Apply triangular wave of 15 Volts peak to peak amplitude, 1kHz frequency across input.

Observe the output wave form on CRO. It should be a square wave.

perational Amplifier as Integrating Circuit :-

Connect the circuit as shown in fig. no. (6).

Use resistance R_1, RF (10kΩ) & C_1 (0.1μF).

Connect Audio Frequ- ency Function Generator across input of the circuit & CRO across output.

Apply square wave of 10Volts peak to peak amplitude, 1kHz frequency

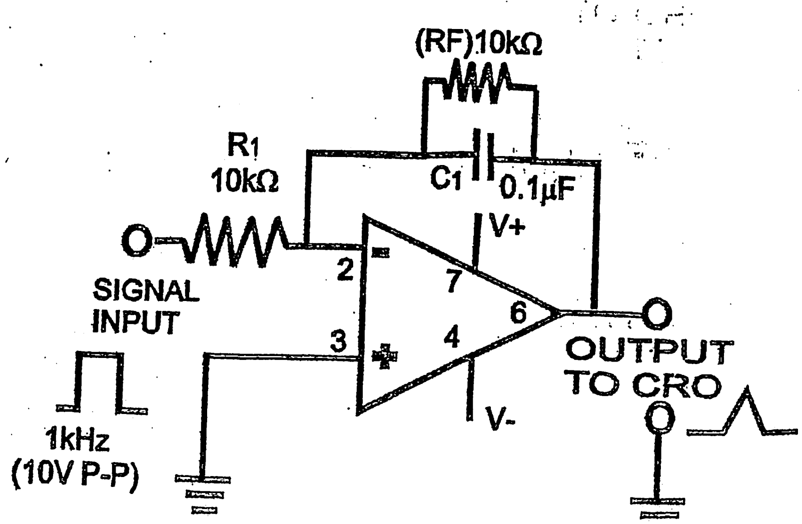

FIG (6) INTEGRATOR CIRCUIT