

## Lab 2: Op Amp Circuits

U.C. Davis Physics 116A

### INTRODUCTION

This lab introduces the operational amplifier or "op amp". The circuit is already constructed for you on a single IC (integrated circuit) and in this lab we will use the IC in several of its most popular configurations. For an introduction to op amps, see section 2.4 in *Bodvrow*.

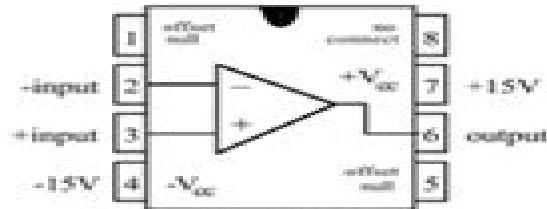


Figure 1: Pinout for the 741 op-amp.

### 1. INVERTING AMPLIFIER

The pinout diagram for the LM741 op amp IC is shown in figure 1. Use this to construct the inverting op amp circuit shown in figure 2.

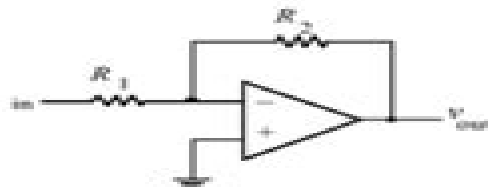


Figure 2: The inverting amplifier.

At first, use  $R_1 = 1\text{k}\Omega$  and  $R_2 = 33\text{k}\Omega$ . Derive the gain formula  $A_v = -R_2/R_1$  and experimentally verify the gain for a 100Hz sine wave. Also calculate and measure the gain with  $R_2 = 10\text{k}\Omega$  and  $R_2 = 100\text{k}\Omega$ . For your lab report, give your derivation and compare the 2 calculated and measured gains. Why is this called an inverting amp?

### 2. NONINVERTING AMPLIFIER

Construct the noninverting amplifier shown in figure 3 with  $R_1 = 1\text{k}\Omega$  and  $R_2 = 33\text{k}\Omega$ . For your report, derive and experimentally verify the gain relation

$$A_v = \frac{R_1 + R_2}{R_1}$$

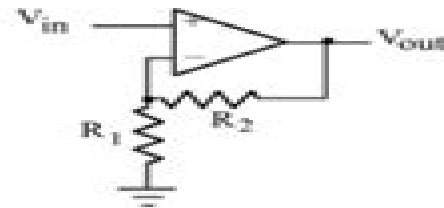


Figure 3: The noninverting amplifier.

### 3. CURRENT-TO-VOLTAGE CONVERTER

An op amp can be used to produce a voltage proportional to a given current. Construct the circuit in figure 4.

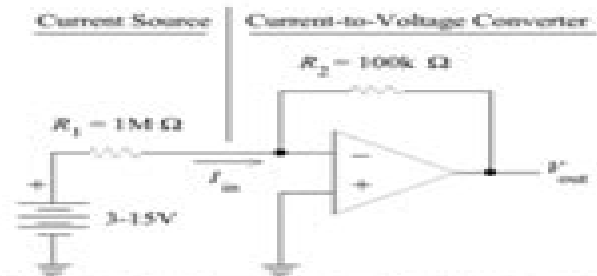


Figure 4: Current source with current-to-voltage converter.

Verify that  $V_{out} = -I_{in}R_2$  for this circuit. (That is, do the following for several voltage settings on the variable power supply: Measure the supply voltage and from this calculate  $I_{in}$ . Use the formula to calculate a theoretical  $V_{out}$  and compare this to a measured  $V_{out}$ . Include these measured values and calculations in your report along with a brief discussion of the agreement between theory and measurement.)

# Opamp Lab Manual

**Léo Pomar**



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