

Inverting Operational Amplifier

Student Group

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Inverting Operational Amplifier

Gain of Op-Amp

Build the following circuit in [figure 1](#) with the power supply and a multimeter.



Fig. 1: Inverting Op-Amp

$U_{DD} = 10\text{ V}$, $U_{SS} = -10\text{ V}$, $R_1 = 100\text{ k}\Omega$

Calculate the necessary value for R_2 , so that the output U_{OUT} is $+1.5\text{ V}$. Use the supply voltage of the operational amplifier for U_{IN} .

$U_{IN} =$

$$R_2$$

Analysis of inverting input currents



Fig. 2: Inverting Op-Amp: Analysis of currents of the inverting input

$$U_{DD} = 10\text{V}, U_2 = -10\text{V}, R_1 = 100\text{k}\Omega$$

Use the values from figure 1 for U_{IN}, U_{OUT}, R_2 .

Complete the reference arrows in the schematic of the circuit.

Determine the currents I_1 and I_2 indirectly by measuring the voltage across known resistors

and calculate the algebraic sum of the currents at node N_{12} using Kirchhoff's Current Law (KCL).

$$U_1$$

$$U_2$$

$$I_1$$

$$I_{\text{N2}} \approx 0$$

$$I_{\text{N12}} \approx 0$$

Analysis of inverting input voltages



Fig. 3: Inverting Op-Amp: Analysis of virtual GND of the inverting input

$$U_{\text{DD}} = 10\text{V}, U_{\text{SS}} = -10\text{V}, R_1 = 100\text{k}\Omega$$

Use the values from figure 1 for $U_{\text{IN}}, U_{\text{OUT}}, R_2$.

Complete the reference arrows in the schematic of the circuit.

Take the values for U_1, U_2, U_{OUT} from figure 2.

Calculate the voltage U_{12} using Kirchhoff's Voltage Law (KVL) within the circuit loop.

Verify your calculated result by measuring U_{12} .

$$U_1 \approx$$

$$U_2 \approx$$

$$U_{\text{OUT}} \approx$$

$$\text{Calculated } U_{12} \approx$$

$$\text{Measured } U_{12} \approx$$

Analyse the physical significance of the potential at N_{12} relative to GND (defined as U_{12}) in the context of the operational amplifier's input configuration. What do you observe?

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What happens if you short-circuit R_2 (the feedback resistor)? Experimentally verify this effect and explain the observed behavior regarding the output voltage.

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