

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

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

Calculate the necessary value for R_2 , so that the output U_{OUT} is $+5\text{ V}$. 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

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

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

Complete the 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).

$$U_1$$

$$U_2$$

$$I_1$$

$$I_2$$

$$I_{N12}$$

Analysis of inverting input voltages



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

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

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

Complete the reference arrows in the scematic 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} .

$$U_1$$

$$U_2$$

$$U_{OUT}$$

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

Measured U_{12}

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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Last update: **2026/04/29 08:44**

