

PART 5

Analyzing Non-Ideal Characteristics of Operational Amplifier

Experiment 1.2: Adjusting Output Offset Voltage of Opamps (1.2)

Experiment 1.3: Measuring The Input Bias Current of Opamps (1.3)

Experiment 1.4: Measuring The Input Offset Current and Input Offset Voltage Of Opamps

Experiment 1.6: Measuring Input And Output Impedances Of Inverting Amplifiers

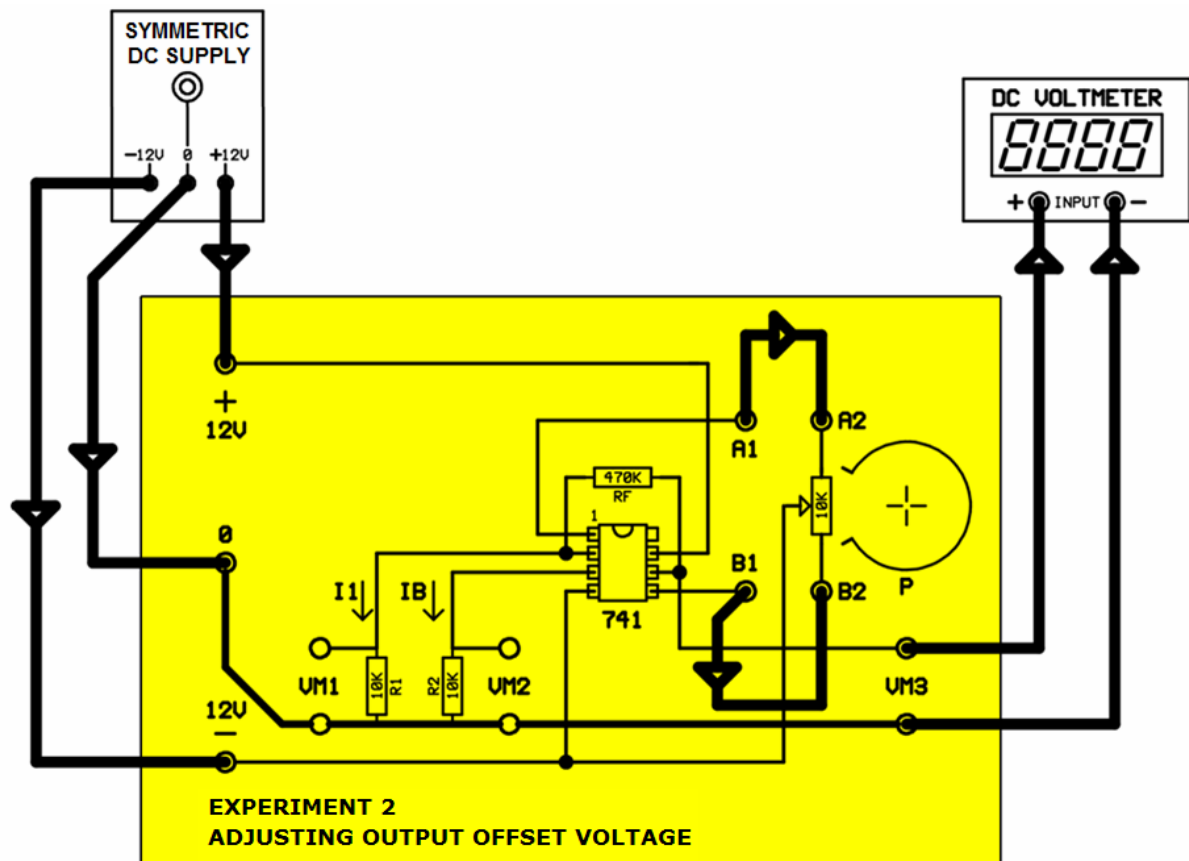
MODULE Y-0014/01

EXPERIMENT 1.2:

ADJUSTING OUTPUT OFFSET VOLTAGE OF OPERATIONAL AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure



- 1- Apply power to the circuit.
- 2- Set the middle pin of the potentiometer P1 to upper position. Measure the offset voltage.

VM3 =

- 3- Set the middle pin of the potentiometer P1 to down position. Measure the offset voltage.

VM3 =

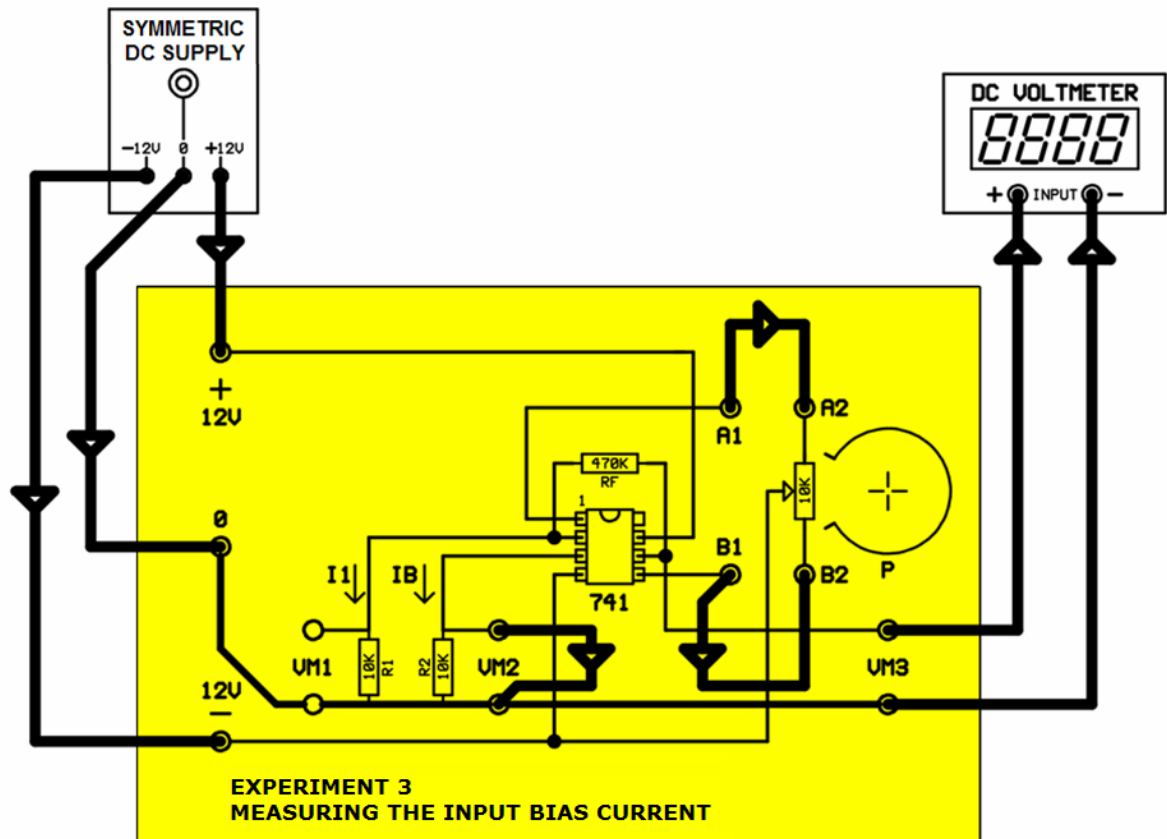
- 4- Adjust the potentiometer P1. Set the output offset voltage to zero. Explain that operation of the circuit.

EXPERIMENT: 1.3

MEASURING THE INPUT BIAS CURRENT OF OPERATIONAL AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure.



- 1- Apply power to the circuit.
- 2- The voltage at VM_3 changes in a wide range while the middle pin of the potentiometer P is at the down or upper position. In order to understand the experiment set the voltage at VM_3 to 75mV.
- 3- What is that voltage? Why is it created?

- 4- Open the short circuit with resistance R2 and measure the output offset voltage.

$V_{M3} =$

- 5- Why did the output offset voltage decrease?

- 6- Calculate the input bias current (I_B)?

If we call the difference voltage V_d ;

$V_d =$

$V_F = I_B \cdot R_F =$

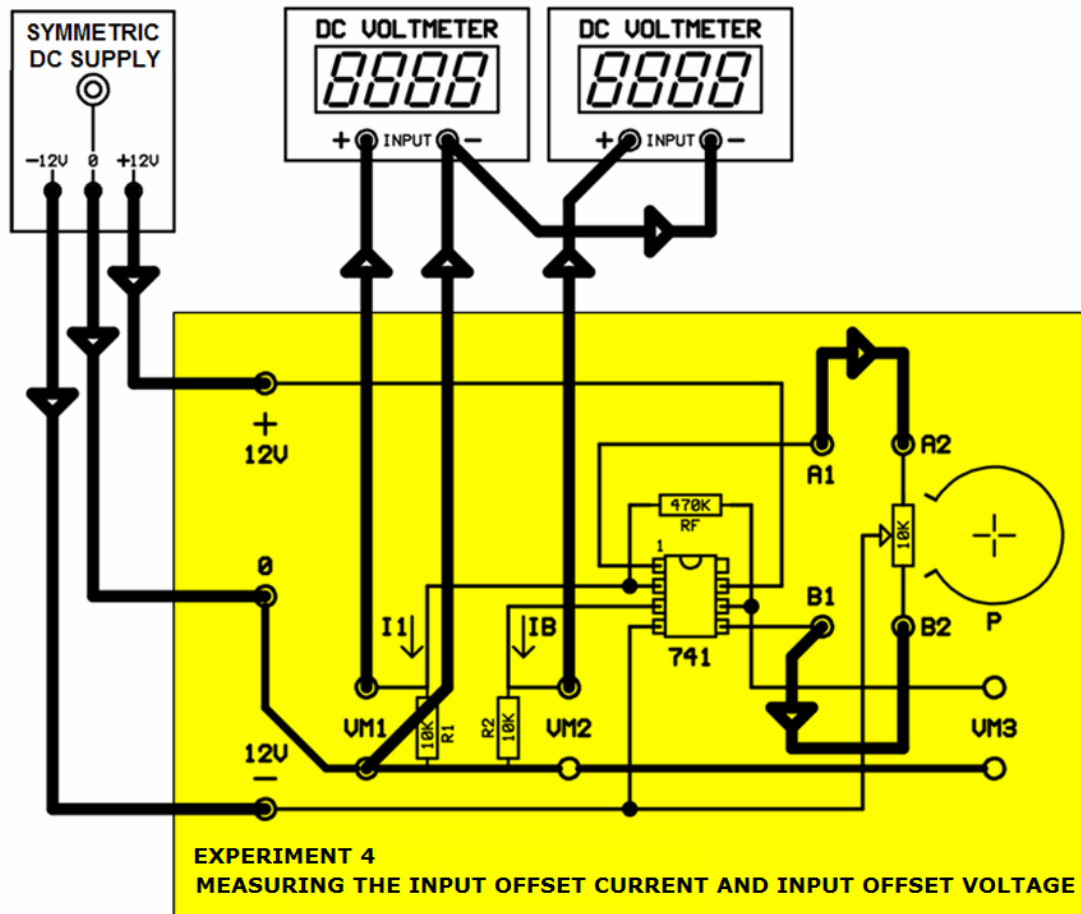
$I_B = \frac{V_d}{R_F} =$

EXPERIMENT: 1.4

MEASURING THE INPUT OFFSET CURRENT AND INPUT OFFSET VOLTAGE OF OPERATIONAL AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure.



- 1- Apply power to the circuit. Set P potentiometer value "0" at VM3
- 2- Read the values at VM1 and VM2.

VM1 =

VM2 =

- 3- Calculate the currents I1 and IB?

I1 = VM1/R1 =

IB = VM2/R2 =

- 4- Calculate the input offset current (I_{iO}).

$$I_{iO} = I_1 - I_B =$$

- 5- Calculate output offset voltage created by the input offset current.

$$I_{iO}.R_F =$$

- 6- Calculate the input offset voltage (V_{iO})

Output offset voltage $V_{oO} =$.

Output offset voltage due to the input bias current is

Output offset voltage due to the input offset current is

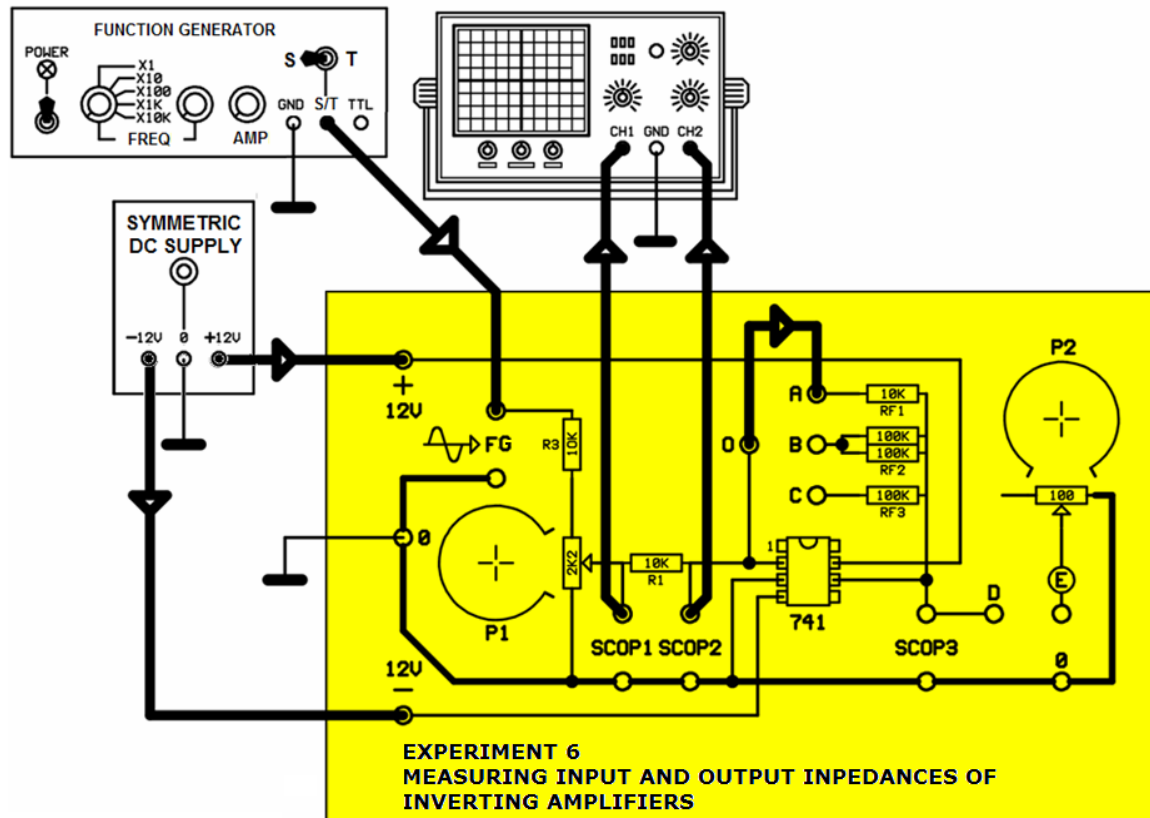
Then the output offset voltage due to the input offset voltage is :

EXPERIMENT: 1.6

MEASURING INPUT AND OUTPUT IMPEDANCES OF INVERTING AMPLIFIERS

EXPERIMENTAL PROCEDURE:

Connect the circuit as shown in the figure.



- 1- Apply power to the circuit. Set the output of the function generator to sinusoidal wave with frequency 1 KHz and amplitude 1V peak to peak by using scope1.
- 2- Measure the amplitude of the signal at Scope2.

- 3- Calculate the current passing through the resistance R1.

$$I_1 = \frac{V_1 - V_2}{R_1} =$$

- 4- Calculate the input impedance of the inverting amplifier.

$$Z_i = \frac{V_1}{I_1} =$$

- 5- What is the relation between the input impedance and the resistance R1?

- 6-** Change the resistance R_F (**short OB or OC**). Is there any change in Scope2?
- 7-** What is the effect of the resistance R_F on the input impedance?
- 8-** Take Scope2 to terminals of Scope3. Again short the points O-A. Measure the output voltage.
- 9-** Short the points D-E. Adjust the potentiometer P2. Set the output voltage half of its value. Open the points D-E and measure the resistance between the points O-E.
- $Z =$
- 10-** What does this resistance value correspond to?
- 11-** Open the short circuit between the points O-A. Short the points O-B. Measure the output voltage.
- 12-** Short the points D-E. Adjust the potentiometer P2. Set the output voltage half of its value. Open short circuit between the points D-E and measure the resistance between the points O-E.
- $Z =$
- 13-** Does the resistance R_F affect the output impedance?
- 14-** Short the output pins (**terminals of Scope3**) via an ampermeter (1mA). Read the current value.
- $I =$
- 15-** Short the output terminals. Does the system operate normally? What does this mean?