Quiz: Instrumentation Amplifier (IA) topologies: two-amp

TI Precision Labs – Instrumentation Amplifiers

Presented by Tamara Alani

Prepared by Tamara Alani

Quiz: (IA) topologies: two-amp || Question

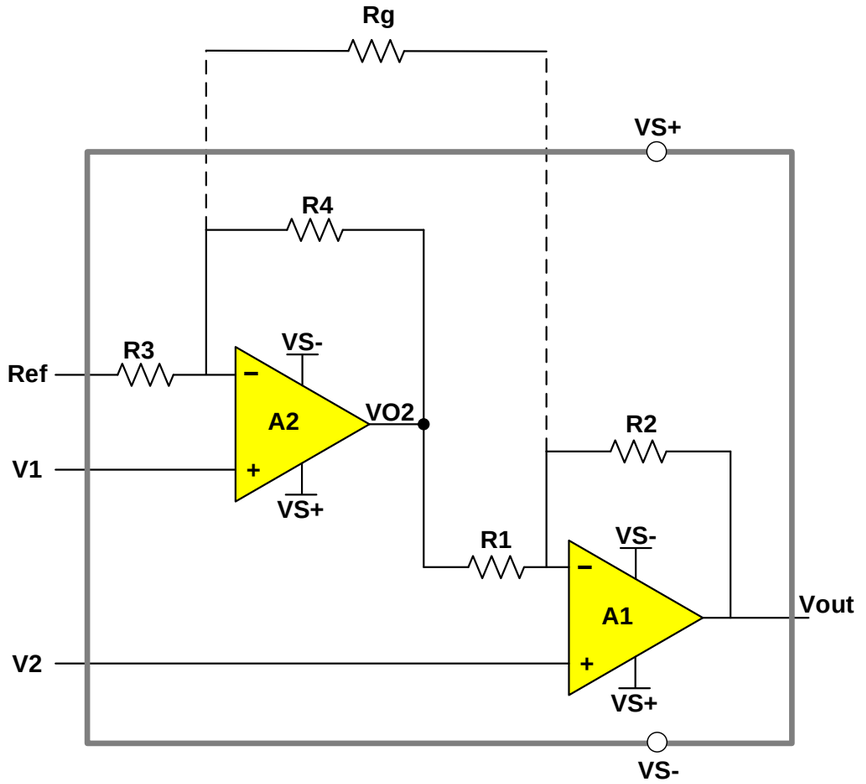
1. What are some challenges associated with the two-amp IA topology? Select all that apply.

a) The path from V1 to Vout has an additional phase shift of A2

a) The two-amp IA must be configured in gains > 1 V/V

a) The two-amp IA consumes more power

b) There is trade-off between VCM and Ref to Gain



Quiz: (IA) topologies: two-amp || Answer

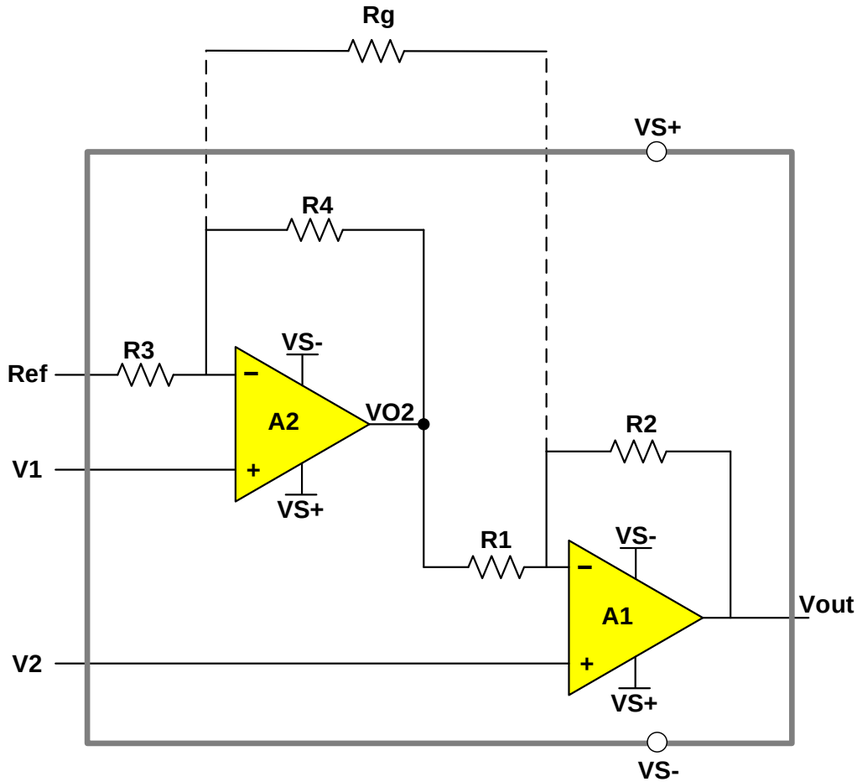
1. What are some challenges associated with the two-amp IA topology? Select all that apply.

a) The path from V1 to Vout has an additional phase shift of A2

a) The two-amp IA must be configured in gains > 1 V/V

a) The two-amp IA consumes more power

b) There is trade-off between VCM and Ref to Gain



Quiz: (IA) topologies: three-amp || Question

2. Which of the following statements is false regarding the reference pin on a two-amp IA?

a) The ref pin must be driven by a low-impedance source
b) The ref pin is used to level-shift the output of the IA
c) The ref pin should be able to source and sink current
d) The ref pin may be driven by a resistor divider so long as the resistors are low tolerance

Quiz: (IA) topologies: two-amp || Answer

2. Which of the following statements is false regarding the reference pin on a two-amp IA?

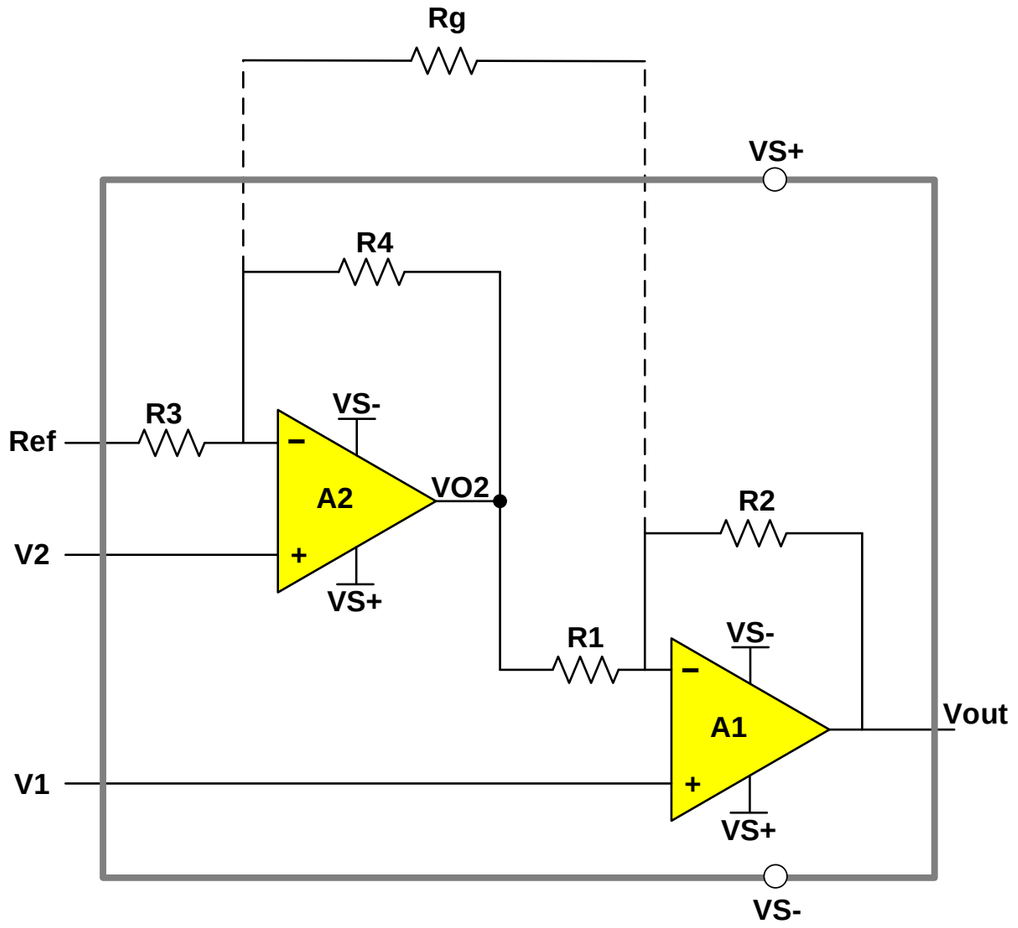
a) The ref pin must be driven by a low-impedance source
b) The ref pin is used to level-shift the output of the IA
c) The ref pin should be able to source and sink current
d) The ref pin may be driven by a resistor divider so long as the resistors are low tolerance

Quiz: (IA) topologies: two-amp || Question

3. In a two-amp IA, which resistors do we aim to match?

   a) R4 = R1 and R2 = R3

   b) R4 = R3 and R2 = R1

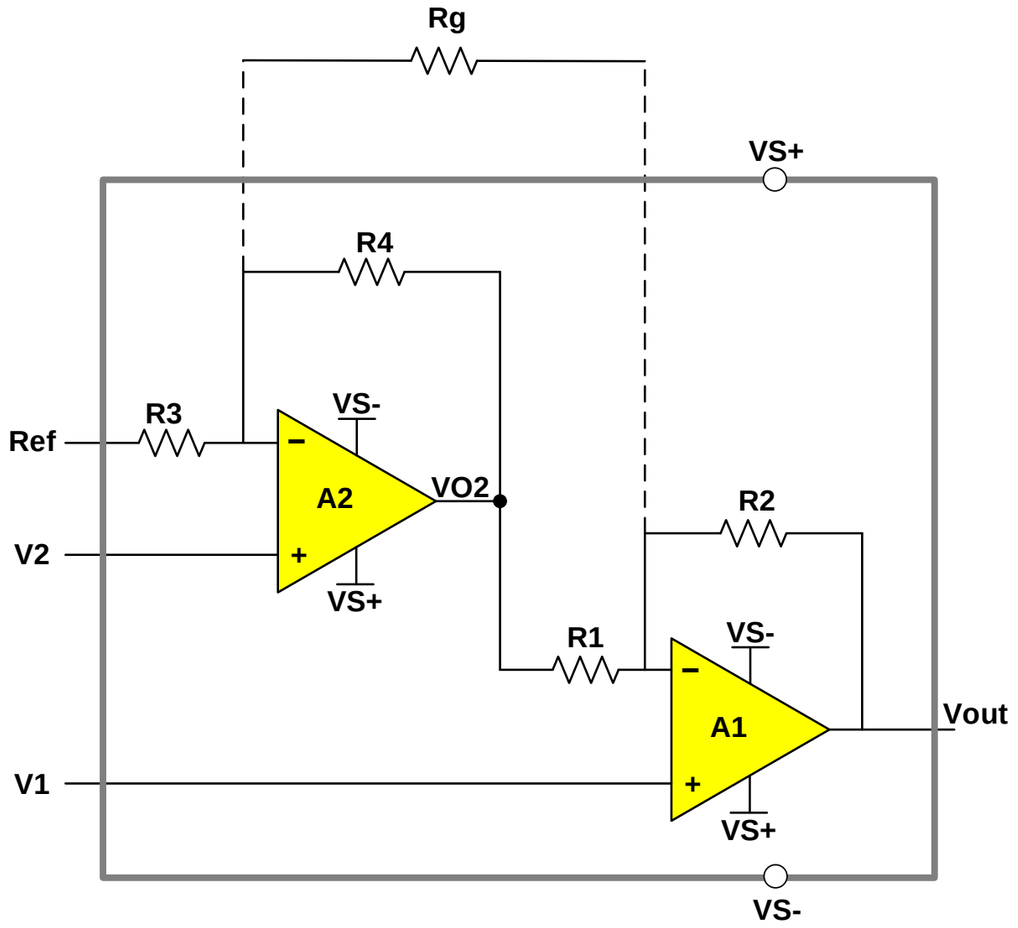


Quiz: (IA) topologies: two-amp || Answer

3. In a two-amp IA, which resistors do we aim to match?

   a) **R4 = R1 and R2 = R3**

   b) R4 = R3 and R2 = R1



Quiz: (IA) topologies: three-amp || Question

4. What is the gain equation of a two-amp IA, assuming we match R4 to R1 and R3 to R2?

a) Gain = $1 + 2 \times R2$

b) Gain = $1 + \frac{R1}{R2}$

c) Gain = $1 + \frac{R2}{R1}$

d) Gain = $2 \times (R1 + R2)$

HINT:

Go to the product datasheet:
https://www.ti.com/lit/ds/symlink/ina126.pdf

Quiz: (IA) topologies: two-amp || Answer

4. What is the gain equation of a two-amp IA, assuming we match R4 to R1 and R3 to R2?

a) Gain = $1 + 2 \times R2$

b) Gain = $1 + \frac{R1}{R2}$

c) Gain = $1 + \frac{R2}{R1}$

d) Gain = $2 \times (R1 + R2)$

HINT:

Go to the product datasheet:
https://www.ti.com/lit/ds/symlink/ina126.pdf

Quiz: (IA) topologies: two-amp || Question

5. Using the INA126 (TI's micro-power IA), what value of Rg do you need to achieve a signal gain of 105V/V?

a) Rg = 100Ω
b) Rg = 200Ω
c) Rg = 800kΩ
d) Rg = 800Ω

HINT:

Go to the product datasheet:
https://www.ti.com/lit/ds/symlink/ina126.pdf

Quiz: (IA) topologies: two-amp || Answer

5. Using the INA126 (TI's micro-power IA), what value of Rg do you need to achieve a signal gain of 105V/V?

a) Rg = 100Ω
b) Rg = 200Ω
c) Rg = 800kΩ
d) Rg = 800Ω

HINT:

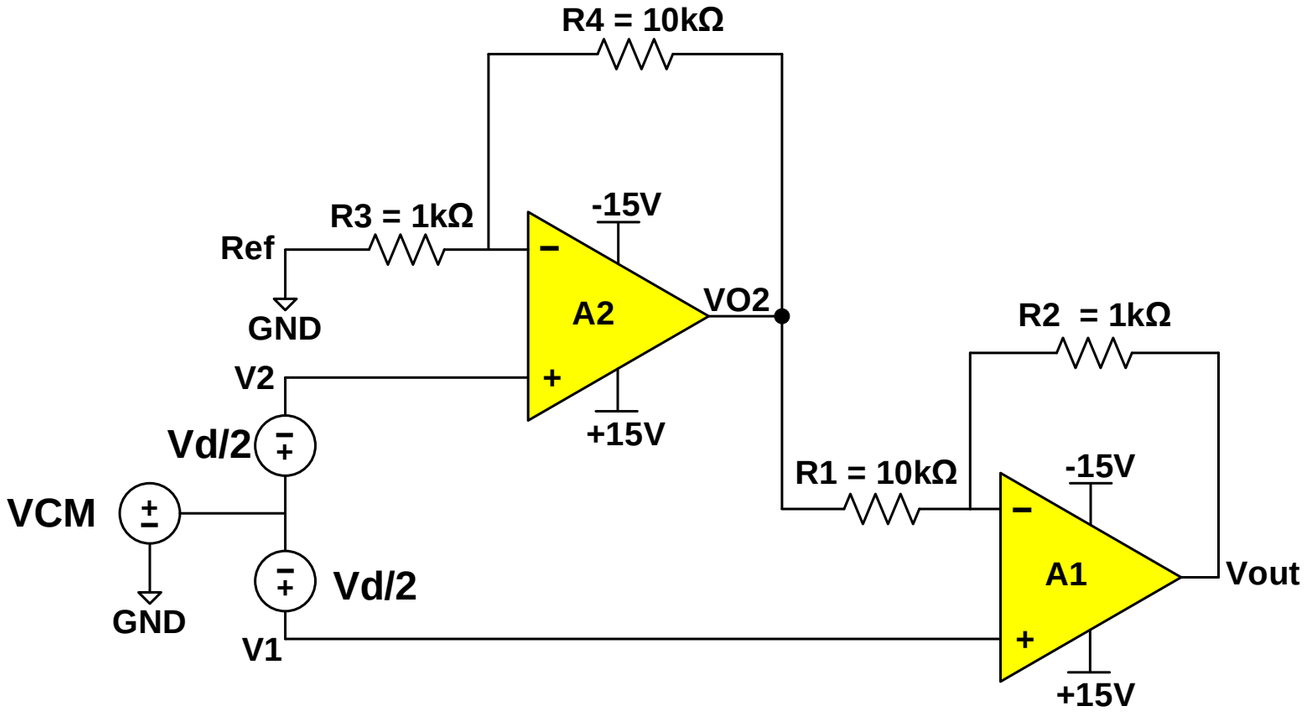
Go to the product datasheet:
https://www.ti.com/lit/ds/symlink/ina126.pdf

$$\text{Gain} = \left(5 + \frac{80\text{k}\Omega}{\text{Rg}}\right)$$

Quiz: (IA) topologies: two-amp || Question

6. What is the differential gain of the following circuit?

a) Gain = 1.1V/V
b) Gain = 2V/V
c) Gain = 0.1V/V
d) Gain = 10V/V



Quiz: (IA) topologies: two-amp || Answer

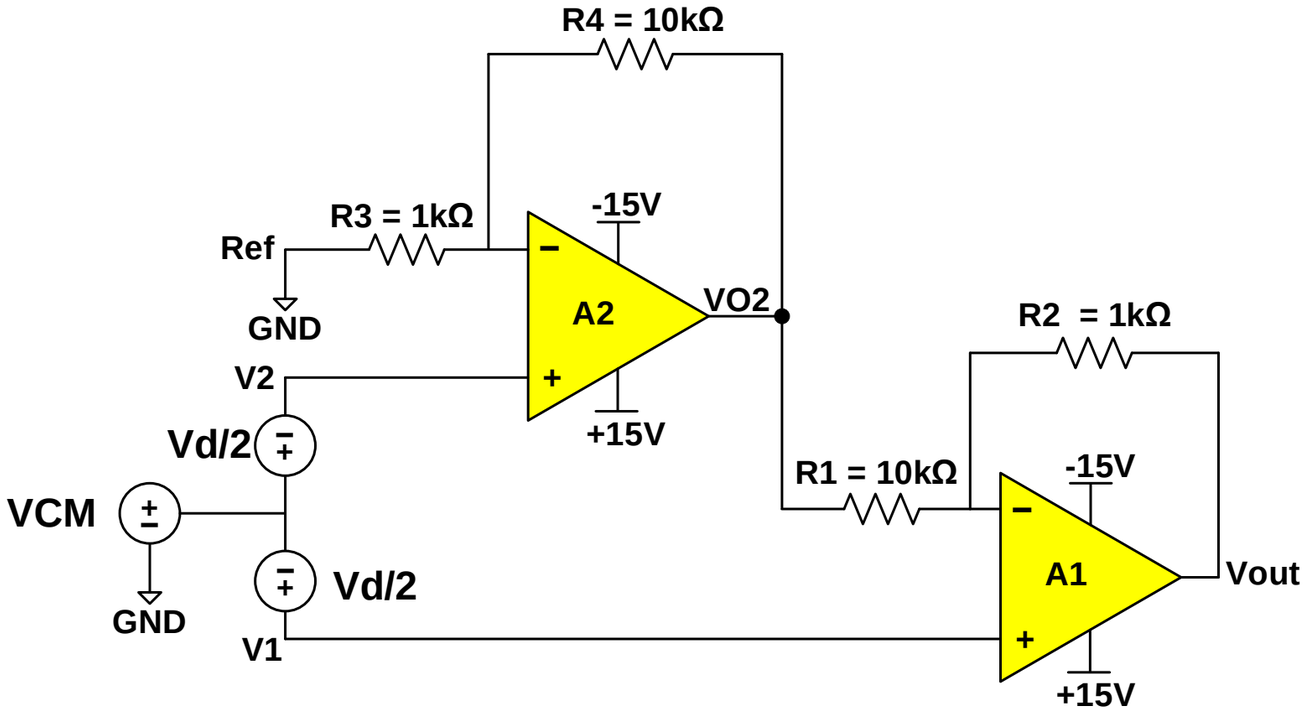
6. What is the differential gain of the following circuit?

a) **Gain = 1.1V/V**

b) Gain = 2V/V

c) Gain = 0.1V/V

d) Gain = 10V/V



Quiz: (IA) topologies: two-amp || Question

7. Using the INA156 (TI's rail-to-rail output swing IA optimized for low-voltage, single-supply operation), create a boundary plot for the following conditions:
   - Voltage supply = 5V single supply
   - Gain = 10V/V
   - Reference = 2.5V
   - Common mode voltage = 2V

HINT:

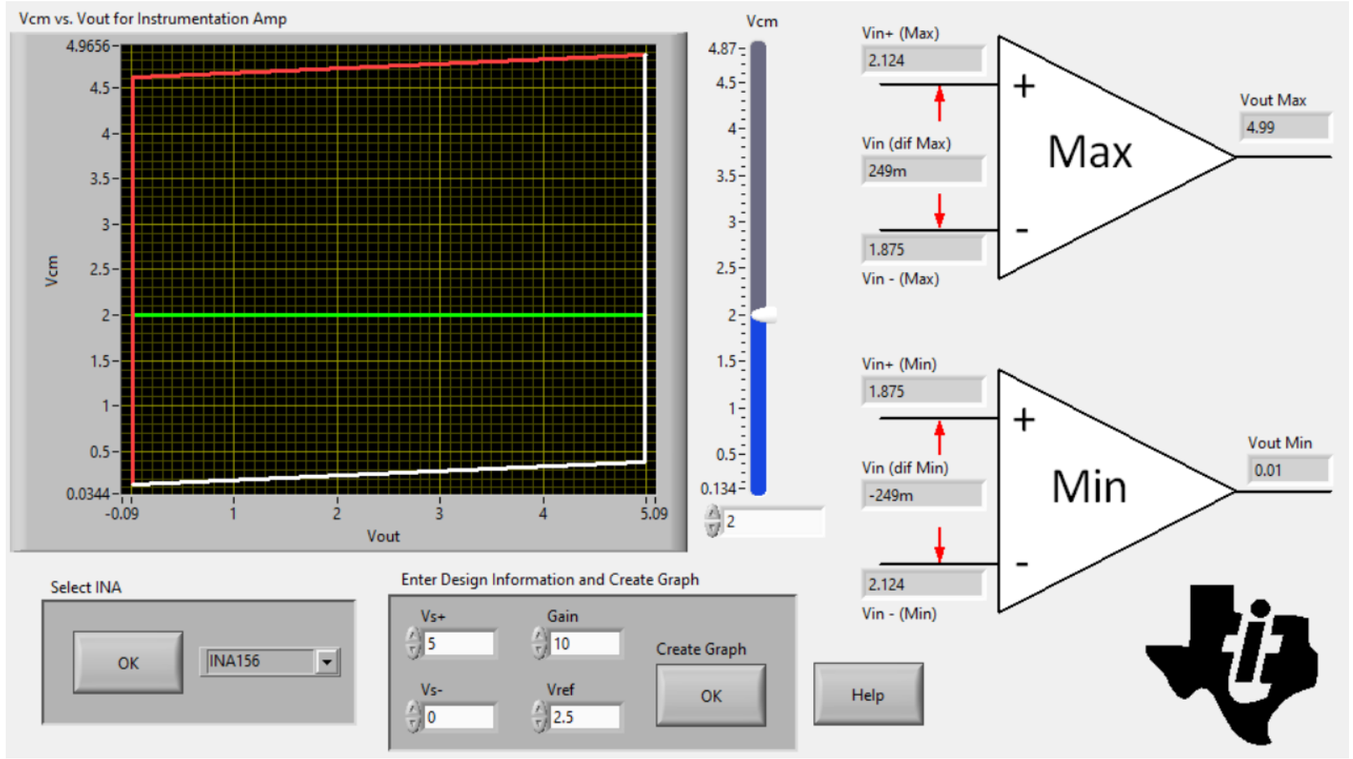
Use the INA Boundary Plot calculator in the **Analog Engineer's Calculator**: https://www.ti.com/tool/ANALOG-ENGINEER-CALC

Quiz: (IA) topologies: two-amp || Answer

7. Using the INA156 (TI's rail-to-rail output swing IA optimized for low-voltage, single-supply operation), create a boundary plot for the following conditions:
   - Voltage supply = 5V single supply
   - Gain = 10V/V
   - Reference = 2.5V
   - Common mode voltage = 2V

HINT:

Use the INA Boundary Plot calculator in the **Analog Engineer's Calculator**: https://www.ti.com/tool/ANALOG-ENGINEER-CALC



Quiz: (IA) topologies: two-amp || Question

8. True or false: In an integrated two-amp IA, all resistors are absolutely matched in production

Quiz: (IA) topologies: two-amp || Answer

8. True or false: In an integrated two-amp IA, all resistors are absolutely matched in production

TRUE

Quiz: (IA) topologies: two-amp || Question

9. Which of the following statements is true regarding the relationship between Ref and VCM to Gain?

a) The further apart Ref is to VCM, lower gains can be achieved
b) The closer Ref is to VCM, lower gains can be achieved
c) If Ref = VCM, gain < 1 V/V can be achieved
d) If Ref << VCM, any gain can be achieved

Quiz: (IA) topologies: two-amp || Answer

9. Which of the following statements is true regarding the relationship between Ref and VCM to Gain?

a) The further apart Ref is to VCM, lower gains can be achieved

b) The closer Ref is to VCM, lower gains can be achieved

c) If Ref = VCM, gain < 1 V/V can be achieved

d) If Ref << VCM, any gain can be achieved

To find more Instrumentation Amplifier technical resources and search products, visit ti.com/inas