

Check the range before the result.

Three fictional scaling problems. Work them by hand, then check in the free calculator.

EXERCISE · ABOUT 10 MINUTES

Use only these exercise assumptions

These raw ranges are invented for practice. They do not describe a specific PLC module. No equipment connection, signal injection or machine change is part of this exercise.

$$EU = EU\ low + (raw - raw\ low) / (raw\ high - raw\ low) \times (EU\ high - EU\ low)$$

Case	Raw range	Engineering range	Your task
A · Zero-based	0 to 10,000	0 to 100 PSI	Find EU at raw 2,500 and 7,500. Find the raw value for 50 PSI.
B · Offset	2,000 to 10,000	0 to 100 PSI	Find EU at raw 6,000. Then use raw 1,000: calculate before and after clamping.
C · Reverse	0 to 10,000	100 to 0 PSI	Find EU at raw 2,500. Find the raw value for 25 PSI.

Check your reasoning

- 1. In case B, why is dividing the raw input by 10,000 incorrect?
- 2. Does clamping an out-of-range value make the input healthy?
- 3. In case C, does increasing the raw value increase or decrease PSI?

Try the complete free calculator

[Open the Analog Scaling Workbench](#)

Select Custom raw range, enter the exercise endpoints, and use PSI as the engineering unit. Choose two display decimals. For case B, compare with Clamp output both off and on. No account is required.

A plausible value is not proof.

Correct arithmetic checks the scale. It does not establish instrument or loop health.

ANSWER KEY · KEEP THE ASSUMPTIONS VISIBLE

Case	Expected result	Reason
A	Raw 2,500: 25.00 PSI Raw 7,500: 75.00 PSI 50 PSI: raw 5,000	Subtract the raw low (0), then divide by the raw span (10,000).
B	Raw 6,000: 50.00 PSI Raw 1,000: -12.50 PSI unclamped Raw 1,000: 0.00 PSI clamped	The raw span is 8,000, not 10,000. At raw 1,000, span position is -12.5%. The input remains underrange.
C	Raw 2,500: 75.00 PSI 25 PSI: raw 7,500	Engineering span is -100 PSI. The formula preserves the reverse relationship.

The offset case, step by step

At raw 6,000: $(6,000 - 2,000) / (10,000 - 2,000) = 0.5$.
EU = $0 + 0.5 \times 100 = 50$ PSI.
At raw 1,000: $(1,000 - 2,000) / 8,000 = -0.125$, giving -12.5 PSI.

What the exercise cannot tell you

Clamping changes the displayed value; it does not remove the range condition. For real work, verify the exact module representation, configured signal mode, transmitter range, status bits and approved site procedure. Do not infer a wiring fault from this arithmetic alone.

Need to record a repeated check?

The free calculator remains complete. An optional [Pro calibration preview](#) shows five-point readings and tolerance checks. Inspect it before choosing a plan; local records are not cloud-synced.

[Current plan details](#) · Share this unmodified exercise with colleagues or students.