# Coordinates: know the reference

Worksheet + explained answers

## FOUR DIFFERENT CONCEPTS

Machine coordinates describe positions in the machine system. Axis referencing establishes the required position relationship where applicable. Work zero is the job origin. Drawing datums define part requirements; they are not automatically CNC work zero.

## SIMPLIFIED MODEL

One dimension, millimetres, parallel positive directions, translation only. No rotations, tool compensation, scaling or kinematic transformations. These numbers are not machine offset-entry instructions.

## WORKED EXAMPLE

Machine origin M = 0. Work origin W is at machine coordinate 200. Point P is at machine coordinate 250. Work coordinate of P: 250 - 200 = +50 mm. Same point, different origin.

## TRY IT YOURSELF

Use P_work = P_machine - W_machine. A: P = 310, W = 240. B: P = -120, W = -180. C: P = 30, W = 70. Calculate each work coordinate. Then keep P = 250 fixed and change W from 200 to 220: what changes, and what does not?

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## EXPLAINED ANSWERS

A: 310 - 240 = +70 mm. B: -120 - (-180) = +60 mm. C: 30 - 70 = -40 mm. With P fixed at 250 and W at 220, P_work = +30 mm. The physical point has not moved; its description has changed.

## BEFORE INTERPRETING A POSITION

Identify the display and coordinate frame; units and sign convention; active origin and transformations; the physical point represented; applicable tool compensation; approved instructions and authority. If uncertain, obtain clarification before moving or editing data.

## KNOWLEDGE CHECK

1. Does referencing locate the workpiece? 2. Is a drawing datum automatically work zero? 3. Is displayed zero automatically a safe position? Answers: no, no, no. Each concept has a different purpose; safety depends on the actual machine and setup.

## MY CLARIFICATION RECORD

Display / task: _____
What is uncertain? _____
Responsible person: _____
Approved explanation / document: _____