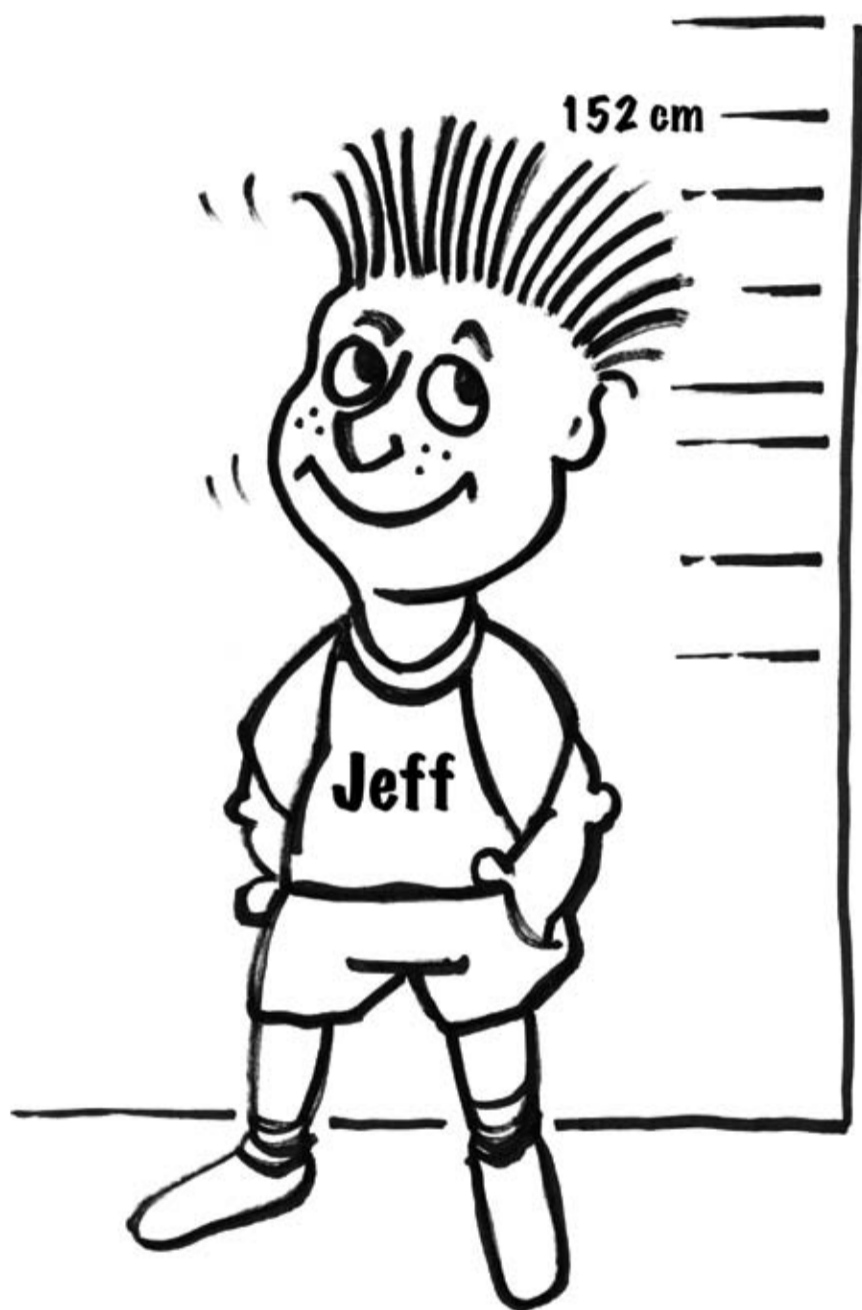


A measurement can never be exactly right it will always be subject to a certain amount of uncertainty. Uncertainty describes the quality and accuracy of a measurement.

Measure the height of Jeff on a wall. The nearest centimetre will suffice (uncertainty of this measurement is about a centimetre). If uncertainty was reduced to a millimetre the answer would be a lot trickier. Do you flatten his hair?



A good measurement is meaningless without knowing the uncertainty.

Don't Confuse Error with Uncertainty!

Error is difference between the measured value and the true value of object being measured.

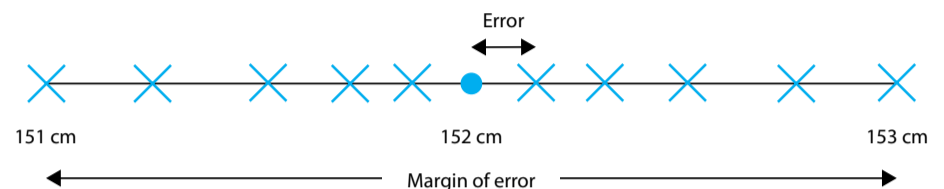
Uncertainty is the quantification of the doubt about the measurement result.

In principle errors are known and corrected. Any error value not known is a source of uncertainty.

When reporting a measurement it includes the maximum and minimum errors in the measurement (spread of measurement).

Expressing uncertainty

By quantifying the possible spread of measurements, we can express uncertainty and say how confident we are about the result. The more measurements that are taken the more confident you can be with the result.



We might say the height of Jeff is 152 cm, plus or minus 1 cm at a 95% confidence level. This is written:

152 cm +/- 1 cm at a confidence level of 95%

This states we are 95% sure that the height of Jeff is between 151 centimetres and 153 centimetres.

Acceptance criteria

You need to know the uncertainty before you can decide if tolerance is met and the measurement fit for purpose. Tolerance is the acceptable uncertainty. For example, an electrical resistor with a specification of 10 ohms and acceptable tolerance of +/- 10%, the minimum acceptable resistance would be 9 ohms, maximum 11 ohms.

Uncertainty can influence a pass or a failure in a particular test, and must therefore be reported on a calibration certificate.

Importance of measurement uncertainty

Particular reasons for thinking about measurement uncertainty, other than just wanting to make good quality measurements and understand the results, include making measurements as part of:

a calibration - where the uncertainty of measurement must be reported on the certificate

a test - where the uncertainty of measurement is needed to determine a pass or fail

meeting tolerance - where you need to know the uncertainty before you can decide whether the tolerance is met

... or you may need to read and understand a calibration certificate or a written specification for a test or measurement.