

Expanded uncertainty and coverage factor

Expanded uncertainty

Although the combined standard uncertainty u_c is used to express the uncertainty of many measurement results, for some commercial, industrial, and regulatory applications (e.g., when health and safety are concerned), what is often required is a measure of uncertainty that defines an interval about the measurement result y within which the value of the measurand Y can be confidently asserted to lie. The measure of uncertainty intended to meet this requirement is termed **expanded uncertainty**, suggested symbol U , and is obtained by multiplying $u_c(y)$ by a **coverage factor**, suggested symbol k . Thus $U = k u_c(y)$ and it is confidently believed that Y is greater than or equal to $y - U$, and is less than or equal to $y + U$, which is commonly written as $Y = y \pm U$.

Coverage factor

In general, the value of the coverage factor k is chosen on the basis of the desired level of confidence to be associated with the interval defined by $U = k u_c$. Typically, k is in the range 2 to 3. When the normal distribution applies and u_c is a reliable estimate of the standard deviation of y , $U = 2 u_c$ (i.e., $k = 2$) defines an interval having a level of confidence of approximately 95 %, and $U = 3 u_c$ (i.e., $k = 3$) defines an interval having a level of confidence greater than 99 %.

Relative expanded uncertainty

In analogy with relative standard uncertainty u_r and relative combined standard uncertainty $u_{c,r}$ defined above in connection with simplified forms of equation (6), the **relative expanded uncertainty** of a measurement result y is $U_r = U/|y|$, y not equal to zero.