

Live TUS Uncertainty Calculation

Johnson Gage & Inspection, Inc

2025

Uncertainty is calculated by combining the repeatability (Type A) and fixed systematic (Type B) components:

$$\nu = mn - 1 \quad (\text{degrees of freedom})$$

$$o_i = o_i^{DaqBook} + o_i^{TC} \quad (\text{cumulative offset for channel } i)$$

$$x'_{i,j} = x_{i,j} + o_i \quad (\text{corrected reading for channel } i \text{ at time } j)$$

$$u_A^2 = \frac{1}{\nu} \sum_{i=1}^n \sum_{j=1}^m (x'_{i,j} - T_N)^2 \quad (\text{Type A standard uncertainty squared})$$

$$u_c = \sqrt{u_A^2 + u_B^2} \quad (\text{combined standard uncertainty})$$

$$U = k \cdot u_c \quad (\text{expanded uncertainty, } k = t_{0.9545, \nu})$$

$$\text{Reported Uncertainty} = \max(U, U_{CMC})$$

Symbol	Definition
n	Thermocouple sample size (Up to 5)
m	Number of readings per thermocouple
i	Thermocouple index ($i \in 1, \dots, n$)
j	Survey time index ($j \in 1, \dots, m$)
ν	Degrees of freedom ($mn - 1$)
$x_{i,j}$	Raw measured temperature from probe i , reading j
$o_i^{DaqBook}$	Offset for DaqBook channel i
o_i^{TC}	Offset for the probe assigned to channel i
o_i	Total correction offset for probe/channel i
$x'_{i,j}$	Corrected temperature for probe i , reading j
T_N	Nominal temperature
u_A	Type A standard uncertainty
u_B	Type B standard uncertainty from the MUG
u_c	Combined standard uncertainty
k	Coverage factor (t -distribution, 95.45%)
U	Expanded uncertainty
U_{CMC}	Minimum reportable uncertainty, as listed in the current scope.