



Decision Rules & Guard Band Calculator — Instruction Guide

The Decision Rules & Guard Band Calculator decides whether one measured value conforms to a symmetric tolerance, under the decision rule you choose, and compares that verdict with three other rules.

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1. Purpose and application

Use the calculator to turn a measured value, its expanded uncertainty and a tolerance into a pass/fail decision that names its decision rule. It returns the verdict, the guard band, the acceptance limits, the TUR, the margins and a conformity statement ready to adapt for a certificate.

Typical uses:

- Checking an as-found or as-left reading against a manufacturer, customer or procedure tolerance.
- Showing a customer how the choice of rule changes the decision, before the rule is agreed.
- Training technicians on how uncertainty moves a reading from "pass" to "in the guard band".

The calculator evaluates all four rules for every request. The rule you select sets the headline, the card and the conformity statement. The other three are passed to the explanation, so the tutor can say which rules would accept or reject the same reading.

The calculator assumes one quantity, one reading and a tolerance symmetric about a nominal value. It is a training and decision-support tool. The laboratory remains responsible for the rule it agrees with its customer and for the statement it issues.

2. Standards basis

The rules, limits and risk figures come from the documents below. Clause numbers are given only where the clause is what the calculator implements.

Standard	What the calculator takes from it
ISO/IEC 17025:2017, 7.1.3	When a customer asks for a statement of conformity, the decision rule must be defined, communicated and agreed. The calculator makes the rule an explicit, required choice.
ISO/IEC 17025:2017, 7.8.6	A statement of conformity must identify the results it applies to, the specification met or not met, and the decision rule applied. The conformity statement names all three.
ILAC-G8:09/2019, 4.1 and 4.2.1	Simple acceptance ($w = 0$), which ILAC-G8 also calls shared risk. A reading on a limit is accepted.
ILAC-G8:09/2019, Table 1	Guarded acceptance as $w = r \times U$: $w = U$ (specific PFA below 2.5 %) and the ISO 14253-1:2017 rule $w = 0.83 U$ (specific PFA below 5 %).
ILAC-G8:09/2019, binary and non-binary statements	All four rules give a binary statement (conforming or not conforming). Non-binary statements ("conditional pass") and guarded rejection are not offered.

Standard	What the calculator takes from it
JCGM 106:2012, 3.3.9	The acceptance interval is closed: a reading exactly on an acceptance limit is accepted.
JCGM 106:2012, 8.3.2	Guarded acceptance with $w = U$, the stringent rule (8.3.2). Its $< 2.5\%$ specific-PFA figure is from ILAC-G8 Table 1.
ANSI/NCSL Z540.3-2006, 3.11	The calculator computes $TUR = T / U$ as entered. This equals the Z540.3 3.11 TUR (span / $2 \cdot U_{95}$) only when U is about a 95 % expanded uncertainty. The standard was withdrawn in October 2020; its methods remain in use.
NCSLI Handbook for the Application of ANSI/NCSL Z540.3-2006, Appendix A	Guard Band Method 6, which limits global PFA to 2 % or less from the TUR alone. Tables A16 and A17 are the published known answers.
ISO 14253-1:2017	The guarded-acceptance rule as summarized in ILAC-G8 Table 1 ($w = 0.83 U$ at $k = 2$).
UKAS LAB 48 (Ed. 5, 2024), Example 13	Published verdicts for simple acceptance and $w = U$, used as known answers.

3. How the calculator ensures accurate results

Code computes every number; the language model only explains. The parser reads each field and refuses anything ambiguous. The calculation decides each verdict against the limits, with ties to within a relative 10^{-12} counted as on the limit. The margin-to-uncertainty ratio is decided in exact rational arithmetic from the digits you typed. One presentation function produces the card, the PDF, the Word report and the spreadsheet, so they cannot disagree. The model receives those finished values and may not recompute or re-round them. The method is described in the white paper [Deterministic Computation in AI-Assisted Metrology](#) (Racen, 2026).

Validation record MT-VAL-DR-002 Rev E found 0 mismatches over 6,000 random cases (24,000 rule rows) against independent Python references. All 17 known answers were reproduced: Z540.3 Handbook Tables A16 and A17 and UKAS LAB 48 Example 13. Numerical integration confirmed the printed risk claims: Method 6 worst-case global PFA 1.968 % (claim $\leq 2\%$), ISO 14253-1 4.846 % (claim $< 5\%$), stringent 2.275 % (claim $< 2.5\%$). A 2,000-case stream built near the limits showed 0 displays contradicting a verdict, and all 13 live tests passed.

4. Input fields

The form has ten fields, in this order. The help text shown under each field is quoted in the last column.

Field	Required	Format or options	What it means
Measurand	Optional	Free text, e.g. DC Voltage at 10 V using a 6.5-digit DMM	"Describe the quantity being measured (e.g., DC Voltage at 10 V, Torque at 100 ft-lbf). Provides context but does not affect the calculation."
Nominal Value	Optional	Number, e.g. 10.000	"The target or reference value for the measurement. If omitted, the measured value is treated as a deviation and the tolerance is centered on zero."
Tolerance	Required	Number greater than 0, e.g. 0.050; a leading +/- is accepted	"The symmetric tolerance half-width."
Unit	Required	Free text, e.g. V	"Unit of measurement for tolerance, measured value, and uncertainty. All must be in the same unit."
Measured Value	Required	Number, e.g. 10.042	"The actual measurement result from the calibration or test. Must be in the same unit as the tolerance."
Expanded Uncertainty (U)	Required	Number greater than 0, e.g. 0.015	"The expanded measurement uncertainty, in the same unit as the tolerance. This is U, not u — the expanded value that includes the coverage factor."
Coverage Factor (k)	Required	Number greater than 0; default 2	"The coverage factor used to compute the expanded uncertainty U. Typically k = 2 for approximately 95% confidence."
Decision Rule	Required	One of four options (4.1)	"The decision rule to apply for the conformity evaluation. This determines whether and how measurement uncertainty affects the acceptance decision." The help text continues with one sentence per option; see 4.1.
Confidence Level	Required	95%, 95.45% or 99%; default 95%	"The confidence level associated with the expanded uncertainty U."
Specification Source	Optional	Free text, e.g. Keysight 34401A specifications, 1-year accuracy	"The source of the tolerance specification (e.g., manufacturer datasheet, customer specification, calibration procedure). Included in the conformity statement."

Numbers use a period as the decimal mark. Exponent notation such as 5e-2 is accepted. A thousands comma (1,000.000) is refused.

4.1 Decision Rule

Option	Guard band w	Help text for this option
Simple acceptance (shared risk)	0	"Simple acceptance (shared risk) accepts up to the tolerance limit (ILAC-G8:09/2019 4.1)."
Guard-banded 2% PFA (Z540.3 Method 6)	$M2\% \times U95$	"Guard-banded 2% PFA uses Guard Band Method 6 of the ANSI/NCSL Z540.3-2006 Handbook and requires the expanded uncertainty at about 95 % coverage."
ISO 14253-1:2017 (w = 0.83U)	$0.83 \times U$	"ISO 14253-1:2017 uses a guard band w = 0.83U (ILAC-G8 Table 1) and requires U at k = 2."
Stringent acceptance (w = U)	U	"Stringent acceptance uses w = U and requires U at k of 1.96 or more."

The rules are listed from least to most conservative at TUR 1:1 and above. A reading accepted by stringent acceptance is accepted by every other rule.

4.2 Confidence Level

95% and 95.45% are accepted for every rule. 99% is accepted for every rule except the guarded rule (see 4.4). Simple acceptance, ISO 14253-1 and stringent acceptance do not use the level in the calculation.

4.3 Nominal Value

When you leave Nominal Value empty, the specification becomes $0 \pm T$ and the measured value is read as a deviation. The card then shows Nominal Assumed: Yes. When you enter a value the parser cannot read, the request is refused rather than silently set to zero.

4.4 Rule-dependent requirements

No field is hidden or shown by another field. Three combinations are checked after you submit. MetTutor does not rescale U between coverage levels or coverage factors.

Decision Rule	Requirement	Why
Guard-banded 2% PFA (Z540.3 Method 6)	Confidence Level 95% or 95.45%	Method 6 and the Z540.3 TUR are defined for U95
ISO 14253-1:2017 (w = 0.83U)	Coverage Factor (k) exactly 2	The < 5 % risk figure assumes $0.83 U = 1.66 u$
Stringent acceptance (w = U)	Coverage Factor (k) of 1.96 or more	The < 2.5 % risk figure needs w of at least $1.96 u$

5. Units and unit conversion

This calculator does not convert units and offers no unit domains. The Unit field is free text, and Tolerance, Measured Value, Expanded Uncertainty (U) and Nominal Value must all be in that one unit. The unit-domain table shared by the TUR, TAR, Type B and GUM calculators is not used here.

- **Bare numbers.** Enter values as plain numbers; the declared unit applies to all of them.
- **Inline units.** A value may carry a unit only if it is exactly the declared unit. "0.050 V" with Unit V is accepted and shown as 0.050.
- **Case matters.** The check is case-sensitive, because SI prefixes are: mV is milli, MV is mega.
- **No spelled-out units.** "10 volts" with Unit V is refused, as is "10.02 mV" with Unit V.
- **Percent tolerances.** There is no reference-value conversion. Convert a percent-of-reading or percent-of-range tolerance to the measurement unit before you enter it.
- **Coverage factor.** k is dimensionless and is never checked against the unit.

If your uncertainty is in a different unit from the tolerance, convert it first, for example with the SI Unit Converter, and enter the converted value.

6. Calculation method

Every rule shrinks the tolerance by a guard band w on each side and accepts a reading inside what remains. Only w differs between the rules.

Specification, TUR and standard uncertainty. N is the nominal (0 when omitted), T the tolerance half-width, y the measured value.

$$\mathrm{USL} = N + T, \quad \mathrm{LSL} = N - T, \quad \mathrm{TUR} = \frac{2T}{2U} = \frac{T}{U}, \quad u = \frac{U}{k}$$

Guard band for each rule.

$$w_{\text{simple}} = 0, \quad w_{\text{ISO 14253-1}} = 0.83U, \quad w_{\text{stringent}} = U$$

$$w_{\text{Method 6}} = M_{2\%}U_{95}, \quad M_{2\%} = 1.04 - e^{\ln(\mathrm{TUR}) - 0.54}$$

Method 6 is applied as follows:

- **1:1 ≤ TUR < 4.59:1.** w = M2% × U. M2% falls from 45.7 % at 1:1 to 0 at TUR 4.5918.
- **TUR ≥ 4.59:1.** M2% would be negative, so w = 0. No guard band is needed for 2 % PFA. The method is not cut off at 4:1.
- **TUR < 1:1.** Method 6 is not extrapolated. No acceptance zone exists and the verdict is not conforming.

Acceptance limits and verdict.

$$A_L = \mathrm{LSL} + w, \quad A_U = \mathrm{USL} - w, \quad \text{conforming} \iff A_L \leq y \leq A_U$$

The interval is closed. A difference within $10^{-12} \times \max(|y|, |\mathrm{USL}|, |\mathrm{LSL}|)$ counts as zero, so a reading exactly on a limit is accepted despite binary rounding. A TUR within that tolerance below 1:1 is treated

as 1:1. When w exceeds T the zone is empty and nothing is accepted. When w equals T the zone is the single value N , and a reading at N is accepted.

Margins.

$$m = \min(\mathrm{USL} - y, y - \mathrm{LSL}), \quad \frac{m}{U}, \quad m_A = \min(A_U - y, y - A_L)$$

A negative m means the reading is outside the tolerance. A negative m_A means it is outside the acceptance zone.

Display rules for this calculator. "Finest entered" means the most decimals among Measured Value, Nominal Value and Tolerance as typed; if any of those three is typed in exponent notation, limits fall back to 6 significant figures.

Quantity	Display rule	Why
Specification limits USL, LSL	Decimals of Nominal Value and Tolerance as entered	$N \pm T$ is exact at the entered precision
Acceptance limits, guarded rules	Nearest, one decimal finer than the finest entered, as the Z540.3 Handbook prints them. Decimals are added one at a time, up to 12, only where nearest rounding would put the reading on the wrong side of a shown limit.	A reading is never shown on the wrong side of a displayed limit
Acceptance limits, $w = 0$	Shown as the specification limits	They are the specification limits
$y - U$ and $y + U$	Same precision as the acceptance limits, extended only until each end agrees with the specification limit it is compared with	Same reason
Margins m and m_A	Nearest at the same precision, sign kept; within the tie tolerance shown as 0	A reading outside never shows a positive margin
Margin-to-uncertainty ratio	Truncated toward zero at 3 significant figures, decided exactly	0.99996 is never shown as 1
TUR	Truncated to 2 decimals, e.g. 3.33:1	A TUR never appears to reach 1:1, 2:1 or 4:1 when it does not
Guard band w	2 significant figures, like U	
$u = U/k$	3 significant figures	
M2 fraction, g/T , guard band fraction	4 significant figures	

7. Reading the results

The headline gives the verdict first, then the specification, the TUR and the guard band of the rule you selected:

CONFORMING — 10.042 V vs 10.000+/-0.050 V, TUR 3.33:1, g=0.0018 V (Z540.3 Method 6)

The tag in brackets names the rule: (Z540.3 Method 6), (ISO 14253-1, 0.83U) or (w = U). Simple acceptance has no tag and shows g=0. Below 1:1 the guarded rule shows "g=none (TUR below Method 6 range)".

Result rows on the card, in the order shown:

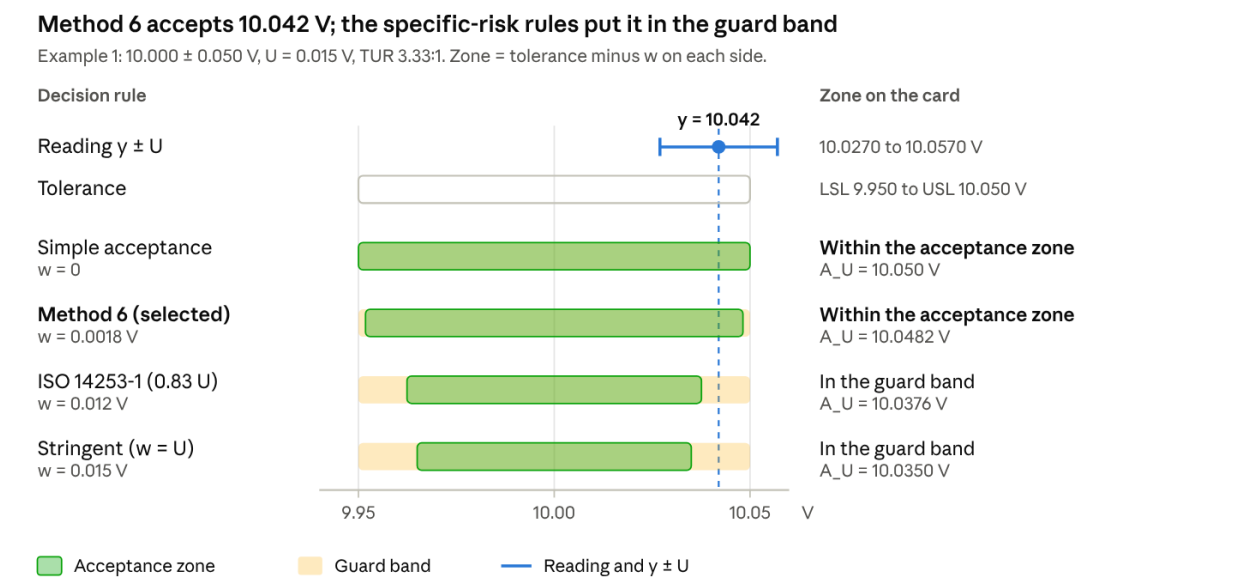
Card row	What it shows
Specification — Nominal, Tolerance, Unit	The specification as read (Nominal 0 when omitted)
Specification — Usl, Lsl	Upper and lower specification limits
Specification — Nominal Assumed	Yes when Nominal Value was left empty
Measurement — Value, Expanded Uncertainty, Coverage Factor	Your inputs, echoed
Measurement — Standard Uncertainty	$u = U/k$
Measurement — TUR, TUR String	T/U, truncated: 3.33 and 3.33:1
Uncertainty Interval — Lower, Upper	$y - U$ and $y + U$
Decision Rule Label	The rule you selected, in the form's words
Guard Band — Applied, Fraction, Width	Whether $w > 0$, w/T , and w
Lookup — TUR, Method, M2 Fraction, G Over T, Source	How w was obtained and its citation; M2 Fraction appears for Method 6 only
Acceptance Zone — AI Lower, AI Upper	The acceptance limits A_L and A_U
Conforming	Yes or No: the binary verdict
Zone	Where the reading sits (below)
Conformity Statement	A paragraph naming the reading, the specification, the rule and the verdict, with its ISO/IEC 17025 7.8.6 reference
Risk Analysis — Margin To Nearest Limit, Margin To Uncertainty Ratio, Acceptance Margin	m , m/U and m_A

Zone words. Zone describes position; Conforming is the decision.

Zone	Meaning	Conforming
Within the acceptance zone	$A_L \leq y \leq A_U$	Yes
In the guard band	Inside the tolerance but outside the acceptance zone, or the zone is empty	No
Outside tolerance	$y < LSL$ or $y > USL$	No
No acceptance zone	Guarded rule at TUR below 1:1; Method 6 defines no zone	No

Method words (Lookup — Method): Z540.3 Handbook Method 6 · Method 6: no guard band needed (TUR ≥ 4.59:1) · Below the Method 6 range (TUR < 1:1) · ISO 14253-1: w = 0.83 U · Stringent: w = U · None (simple acceptance).

The four-rule comparison. The calculator always evaluates simple acceptance, Method 6, ISO 14253-1 and stringent acceptance. Their limits and verdicts go to the explanation, not to card rows. The tutor's text below the card uses them to say which rules accept the reading.



decision-zone number line · Example 1, four rules

Figure 1. Decision zones for Example 1 under the four rules. The dashed line is the reading, 10.042 V; the whisker is $y \pm U$. Method 6 and simple acceptance accept it; ISO 14253-1 and stringent acceptance place it in the guard band.

The PDF, Word and spreadsheet exports carry the same strings as the card. Only the explanation is written by the language model.

8. Worked examples

Every result value below was copied from a run of the production calculator on the composed form text, and checked by hand.

Example 1 — DMM reading under Method 6

Field	Entered
Measurand	DC Voltage at 10 V using a 6.5-digit DMM
Nominal Value	10.000
Tolerance	0.050
Unit	V
Measured Value	10.042
Expanded Uncertainty (U)	0.015
Coverage Factor (k)	2
Decision Rule	Guard-banded 2% PFA (Z540.3 Method 6)
Confidence Level	95%
Specification Source	Keysight 34401A specifications, 1-year accuracy

Hand calculation.

1. $USL = 10.000 + 0.050 = 10.050$ V; $LSL = 9.950$ V.
2. $TUR = 0.050 / 0.015 = 3.3333\dots$, truncated to 3.33:1.
3. $M2\% = 1.04 - e^{(0.38 \times \ln 3.3333 - 0.54)} = 0.119180$ (11.9 %).
4. $w = 0.119180 \times 0.015 = 0.0017877$ V, shown as 0.0018 V. $w/T = 0.03575$.
5. $A_L = 9.950 + 0.0017877 = 9.9517877$ V; $A_U = 10.050 - 0.0017877 = 10.0482123$ V. Finest entered is 3 decimals, so limits show 4: 9.9518 and 10.0482.
6. $9.9518 \leq 10.042 \leq 10.0482$: conforming.
7. $m = 10.050 - 10.042 = 0.008$ V; $m/U = 0.5333\dots$, truncated to 0.533; $m_A = 10.0482123 - 10.042 = 0.0062$ V.
8. $y \pm U = 10.027$ to 10.057 V; $u = 0.015 / 2 = 0.00750$ V.

Calculator result rows.

Card row	Value
Measurement — TUR String	3.33:1
Measurement — Standard Uncertainty	0.00750
Uncertainty Interval — Lower / Upper	10.0270 / 10.0570

Card row	Value
Guard Band — Width	0.0018
Lookup — M2 Fraction	0.1192
Lookup — G Over T	0.03575
Acceptance Zone — AI Lower / AI Upper	9.9518 / 10.0482
Conforming	Yes
Zone	Within the acceptance zone
Risk Analysis — Margin To Nearest Limit	0.0080
Risk Analysis — Margin To Uncertainty Ratio	0.533
Risk Analysis — Acceptance Margin	0.0062

Interpretation. At TUR 3.33:1, Method 6 needs a guard band of only 0.0018 V to hold global PFA at 2 % or less, so 10.042 V is accepted. The same reading fails the two specific-risk rules. ISO 14253-1 gives $w = 0.012$ V and $A_U = 10.0376$ V; stringent acceptance gives $A_U = 10.0350$ V. Both put the reading in the guard band. Method 6 bounds the average risk over all instruments; the ILAC-G8 Table 1 rules bound the specific risk of any accepted reading, which is largest for a reading at the acceptance limit. That difference is a policy choice, agreed with the customer under 7.1.3.

Example 2 — Handbook Table A17, TUR 2:1 (published known answer)

Field	Entered
Measurand	x
Nominal Value	0
Tolerance	0.10
Unit	V
Measured Value	0
Expanded Uncertainty (U)	0.050
Coverage Factor (k)	2
Decision Rule	Guard-banded 2% PFA (Z540.3 Method 6)
Confidence Level	95%

The Handbook prints M2% 28.2 % and an acceptance limit of ± 0.086 for this case.

Hand calculation.

1. $TUR = 0.10 / 0.050 = 2.00:1$.
2. $M2\% = 1.04 - e^{(0.38 \times \ln 2 - 0.54)} = 0.281645$ (28.2 %).
3. $w = 0.281645 \times 0.050 = 0.014082$ V, shown as 0.014.
4. $A_U = 0.10 - 0.014082 = 0.085918$, shown as 0.086 (3 decimals); $A_L = -0.086$.

Calculator result rows.

Card row	Value
Measurement — TUR String	2.00:1
Guard Band — Width	0.014
Lookup — M2 Fraction	0.2816
Lookup — G Over T	0.1408
Acceptance Zone — AI Lower / AI Upper	-0.086 / 0.086
Conforming	Yes
Zone	Within the acceptance zone

The conformity statement quotes "M2% = 28.2 %".

Interpretation. The calculator reproduces the Handbook value to its printed precision. The record also reproduces A17 at TUR 4:1 (M2% 5.3 %, ± 0.099) and TUR 3:1 (± 0.095), and Table A16's $w = U95$ limits of ± 0.075 and ± 0.050 .

Example 3 — UKAS LAB 48 Example 13, reading 1.85 V

Field	Entered
Measurand	x
Nominal Value	1.7
Tolerance	0.2
Unit	V
Measured Value	1.85
Expanded Uncertainty (U)	0.10
Coverage Factor (k)	2
Decision Rule	Stringent acceptance ($w = U$)
Confidence Level	95%

LAB 48 gives FAIL under its rule DR1 ($w = U$) and PASS under DR2 (simple acceptance).

Hand calculation.

1. $USL = 1.9\text{ V}$, $LSL = 1.5\text{ V}$; $TUR = 0.2 / 0.10 = 2.00:1$.
2. Stringent: $w = 0.10$, so $A_L = 1.600$ and $A_U = 1.800$. $1.85 > 1.800$: not conforming, inside the tolerance.
3. $m = 1.9 - 1.85 = 0.050$; $m/U = 0.5$; $m_A = 1.800 - 1.85 = -0.050$.
4. $y \pm U = 1.750$ to 1.950 ; the upper end passes USL.

Calculator result rows. The second column is the entry as shown; the third is the same entry with Decision Rule set to Simple acceptance (shared risk).

Card row	Stringent acceptance ($w = U$)	Simple acceptance (shared risk)
Guard Band — Width	0.10	0
Acceptance Zone — AI Lower / AI Upper	1.600 / 1.800	1.5 / 1.9
Uncertainty Interval — Lower / Upper	1.750 / 1.950	1.750 / 1.950
Conforming	No	Yes
Zone	In the guard band	Within the acceptance zone
Risk Analysis — Margin To Nearest Limit	0.050	0.050
Risk Analysis — Acceptance Margin	-0.050	0.050

Headlines: "NOT CONFORMING — 1.85 V vs $1.7 \pm 0.2\text{ V}$, $TUR\ 2.00:1$, $g=0.10\text{ V}$ ($w = U$)" and "CONFORMING — 1.85 V vs $1.7 \pm 0.2\text{ V}$, $TUR\ 2.00:1$, $g=0\text{ V}$ ".

Interpretation. Both verdicts match LAB 48. The four-rule comparison places the reading between the rules: Method 6 accepts it ($A_U = 1.872$), while ISO 14253-1 ($A_U = 1.817$) and stringent acceptance reject it.

When extra decimals appear. Enter Nominal Value 10, Tolerance 0.05, Measured Value 10.05, $U\ 0.00004$, $k\ 2$, stringent acceptance. $A_U = 10.05 - 0.00004 = 10.04996$. At the normal 3 decimals it would read 10.050, equal to the reading, yet the verdict is not conforming. The card therefore shows AI Upper 10.04996 and Acceptance Margin -0.00004.

9. Refusals and troubleshooting

A refusal returns no result. The card names the field, what was entered and the fix. The messages below were produced by the production calculator.

Message or situation	Cause	What to do
Could not find "Unit:". Tolerance, measured value, and uncertainty must all be in the same unit -- add "Unit: V".	Unit left empty	Enter the unit shared by all values
"Measured Value: 10.02 mV" carries the unit "mV", but the declared unit is "V". Restate the value in V (or enter it as a bare number) and run it again -- MetTutor will not convert or guess between units.	A value typed with a different unit, or a spelled-out unit such as "10 volts"	Convert the value to the declared unit and enter a bare number
"Tolerance" must be greater than zero. Found: "0".	Tolerance, Expanded Uncertainty (U) or Coverage Factor (k) is 0 or negative	Enter a positive value
Could not find a readable "Tolerance:" value. Enter the symmetric half-width, e.g. "Tolerance: 0.050". Found: "0,05".	Comma used as the decimal mark	Use a period: 0.05
"Nominal Value" value "1,000.000" uses a comma. ... Nominal Value is optional -- remove it to center the specification on zero, or enter it as a plain number, e.g. "Nominal Value: 1000.000".	Thousands separator in a number	Remove the comma
Could not find a readable "Measured Value:". Enter the calibration result, e.g. "Measured Value: 10.042".	Measured Value left empty	Enter the reading
Guard-banded acceptance (Z540.3 Handbook Method 6) requires the expanded uncertainty at about 95 % coverage (U95), but "Confidence Level: 99%" was stated. ... MetTutor will not rescale U between coverage levels.	Method 6 with a 99 % U	Enter U at 95 % (typically k = 2) and select 95%
Guard-banded acceptance (Z540.3 Handbook Method 6) is defined for an expanded uncertainty at about 95 % coverage (U95). State "Confidence Level: 95%" (or 95.45%) ...	Method 6 with no Confidence Level (typed requests only; the form always sends a level)	Select 95% or 95.45%
"Confidence Level: 90%" is not recognised. Use 95%, 95.45%, or 99%.	A level the form does not offer	Choose one of the three options

Message or situation	Cause	What to do
The ISO 14253-1:2017 rule (guard band 0.83 U, ILAC-G8:09/2019 Table 1) is defined for an expanded uncertainty at $k = 2$, but "Coverage Factor (k): 1.96" was entered. ...	ISO 14253-1 with k other than 2	Enter U at $k = 2$
Stringent acceptance (guard band $w = U$, ...) requires U at a coverage factor of at least 1.96, but "Coverage Factor (k): 1.645" was entered. ...	Stringent acceptance with k below 1.96	Enter U at $k \geq 1.96$
"Decision Rule:" must be one of: Simple acceptance (shared risk); Guard-banded 2% PFA (Z540.3 Method 6); ISO 14253-1:2017 ($w = 0.83U$); Stringent acceptance ($w = U$).	An unrecognised rule name	Pick one of the four options
Result shown, Zone: No acceptance zone, headline "g=none (TUR below Method 6 range)"	Method 6 at TUR below 1:1 ($U > T$)	Reduce U to reach TUR 1:1, or choose another rule
Result shown, Zone: In the guard band, AI Lower above AI Upper	$w > T$: stringent with $U > T$, or ISO 14253-1 with $0.83 U > T$; the zone is empty	Reduce U, or use a less conservative rule
Result shown with Nominal Assumed: Yes	Nominal Value left empty	Enter the nominal if the tolerance is about a target value

If a TUR below 2:1 is flagged, the result still stands. The flag warns that the guard band takes a large share of the tolerance.

10. Scope and limitations

- **Symmetric tolerances only.** One-sided and asymmetric specifications are not offered and were not validated.
- **Acceptance rules only.** Guarded rejection and non-binary statements (ILAC-G8 "conditional pass") are not offered.
- **No risk computed for your reading.** The calculator does not compute the PFA or PFR of a specific reading, nor use an in-tolerance probability. The risk figures it prints are properties of each rule, confirmed by integration in the validation record.
- **Normal distributions assumed.** The Method 6 claim assumes normally distributed measurement errors. The ILAC-G8 Table 1 figures also assume a normal distribution with $U = 2u$ for 0.83 U.
- **Method 6 range.** Method 6 is not extrapolated below TUR 1:1, and gives $w = 0$ from TUR 4.5918.
- **No unit conversion.** All values must be entered in one unit (section 5).
- **One reading.** Repeated readings must be reduced to one result, with their scatter included in U, before entry.

- **The explanation.** The text the language model writes below the card is outside the numerical validation. Every number on the card and in the exports is computed in code.
- **Your rule, your responsibility.** The calculator applies the rule you select. Agreeing the rule with the customer and issuing the statement remain the laboratory's responsibility.

11. References

1. ISO/IEC 17025:2017, *General requirements for the competence of testing and calibration laboratories*, 7.1.3 and 7.8.6.
2. ILAC-G8:09/2019, *Guidelines on Decision Rules and Statements of Conformity*, 4.1, 4.2.1 and Table 1.
3. JCGM 106:2012, *Evaluation of measurement data — The role of measurement uncertainty in conformity assessment*, 3.3.9 and 8.3.2.
4. ANSI/NCSL Z540.3-2006, *Requirements for the Calibration of Measuring and Test Equipment*, 3.11 (withdrawn October 2020).
5. NCSLI, *Handbook for the Application of ANSI/NCSL Z540.3-2006*, Appendix A: Guard Band Method 6, Tables A16 and A17.
6. ISO 14253-1:2017, *Geometrical product specifications (GPS) — Inspection by measurement of workpieces and measuring equipment — Part 1: Decision rules for verifying conformity or nonconformity with specifications*.
7. UKAS LAB 48, Edition 5 (2024), *Decision Rules and Statements of Conformity*, Example 13.
8. JCGM 100:2008, *Evaluation of measurement data — Guide to the expression of uncertainty in measurement*.
9. K. Racen, [Deterministic Computation in AI-Assisted Metrology](#), 2026.
10. MetTutor validation record MT-VAL-DR-002 Rev E, *Decision Rules & Guard Band Calculator*, 18 October 2026.

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