Calibration: Error, Hysteresis and Pass/Fail at Five Points

Errors at five calibration points from rising and falling readings, the largest error and hysteresis as a share of span, and the result against a tolerance.

Method: Error and hysteresis as defined in ISA-51.1 (process instrumentation terminology)

Input parameters

Unit system: SI

Parameter	Value	Unit
Reference value at point 1	0	
Reading rising at point 1	0.10000	
Reading falling at point 1	0.30000	
Reference value at point 2	25.000	
Reading rising at point 2	25.200	
Reading falling at point 2	25.400	
Reference value at point 3	50.000	
Reading rising at point 3	50.100	
Reading falling at point 3	50.400	
Reference value at point 4	75.000	
Reading rising at point 4	74.900	
Reading falling at point 4	75.200	
Reference value at point 5	100.00	
Reading rising at point 5	99.800	
Reading falling at point 5	99.900	
Calibrated span	100.00	
Tolerance as a share of span	0.50000	%

Calculated results

Parameter	Value	Unit
Largest error as a share of span	0.40000	%
Largest rising–falling difference (hysteresis plus deadband) as a share of span	0.30000	%
Result (1 = within tolerance, 0 = fails)	1.0000	

Notes for this case

- As found: within tolerance.

Formula and method

$$e = \max \frac{|x_{read} - x_{ref}|}{S}, \quad H = \max \frac{|d_i - u_i|}{S}$$

Variables

x_1	Reference value at point 1	-
u_1	Reading rising at point 1	-
d_1	Reading falling at point 1	-

x_2	Reference value at point 2	-
u_2	Reading rising at point 2	-
d_2	Reading falling at point 2	-
x_3	Reference value at point 3	-
u_3	Reading rising at point 3	-
d_3	Reading falling at point 3	-
x_4	Reference value at point 4	-
u_4	Reading rising at point 4	-
d_4	Reading falling at point 4	-
x_5	Reference value at point 5	-
u_5	Reading rising at point 5	-
d_5	Reading falling at point 5	-
S	Calibrated span	-
ϵ_{max}	Tolerance as a share of span	-
e_{max}	Largest error as a share of span	-
H	Largest rising–falling difference (hysteresis plus deadband) as a share of span	-
pass	Result (1 = within tolerance, 0 = fails)	-

Method and standards

Definitions.

Assumptions and limits

- Five points; same span for all.
- H is the total difference between falling and rising readings, which ISA-51.1 splits into hysteresis and deadband; this tool does not separate them.
- Pass/fail uses the largest error only; a rising–falling difference above the tolerance is flagged in a note.

References

- Error and hysteresis as defined in ISA-51.1 (process instrumentation terminology)

Report details

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Release checks	3 reference cases of this calculator, computed independently, are checked on every release

Results are for engineering estimation. Verify critical designs against the referenced standards and your own data.

This calculator online

https://calc.firecad.com/instrumentation/signals-calibration/calibration-error-hysteresis

Open this case on calc.firecad.com →

Reopens the calculator with the inputs of this report.