LVDT Output Voltage and Displacement

Output voltage of an LVDT for a displacement from its sensitivity and excitation, the displacement for a measured output and the error band from non-linearity.

Method: Linear variable differential transformer output; Lipták (ed.); ...

Input parameters

Unit system: SI

Parameter	Value	Unit
Sensitivity (mV per V of excitation per mm)	45.000	
Excitation voltage (RMS)	3.0000	V
Core displacement from null	1.8000	mm
Full-scale range (±)	2.5000	mm
Measured output (for the inverse)	0.15000	V
Non-linearity (% of full scale)	0.25000	%

Calculated results

Parameter	Value	Unit
Output at the displacement	243.00	mV
Output at full scale	337.50	mV
Displacement for the measured output	1.1111	mm
Error band from non-linearity	6.2500	µm

Notes for this case

• An LVDT's secondary windings are connected in opposition, so the output is zero with the core central and rises linearly, with a phase change of 180° through null, as the core moves: V_o = S·V_e·x, with S in mV/V/mm from the data sheet. A phase-sensitive demodulator gives the sign. Ratiometric signal conditioning (dividing by the excitation) cancels excitation drift. Accuracy within the linear range is set by the stated non-linearity, a percentage of full scale.

Formula and method

$$V_o = S V_e\, x, \quad x_m = \frac{V_m}{S V_e}$$

Variables

S	Sensitivity (mV per V of excitation per mm)	-
V_e	Excitation voltage (RMS)	V
x	Core displacement from null	m
x_{FS}	Full-scale range (±)	m
V_m	Measured output (for the inverse)	V
NL	Non-linearity (% of full scale)	-
V_o	Output at the displacement	V
V_{FS}	Output at full scale	V
x_m	Displacement for the measured output	m
$\pm e$	Error band from non-linearity	m

Method and standards

LVDT output.

Assumptions and limits

- Linear range; RMS voltages; ideal demodulation.

References

Linear variable differential transformer output, Lipták (ed.), Instrument Engineers' Handbook, Vol. 1 Process Measurement and Analysis and Vol. 2 Process Control and Optimization, 4th ed. (CRC Press, 2003-2006)

Report details

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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/lvdt-output-displacement

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Reopens the calculator with the inputs of this report.