

Glossary

LVDT Terminology

Acceleration Error

The maximum difference, at any measurand value within the specified range, between output readings taken with and without the application of specified constant acceleration along specified axes. See transverse sensitivity when applied to acceleration transducer.

Ambient Conditions

The conditions (pressure, temperature, etc.) of the medium surrounding the case of the transducer.

Analog Output

Transducer output which is a continuous function of the measurand, except as modified by the resolution of the transducer.

Best Straight Line

A line midway between the two parallel straight lines closest together and enclosing all output vs. measurand values on a calibration curve.

Calibration

A test during which known values of measurand are applied to the transducer and corresponding output reading are recorded under specified conditions.

Calibration Curve

A graphical representation of the calibration record.

Calibration Cycle

The application of known values of measurand, and recording of corresponding output readings, over the full (or specified portion of the) range of a transducer in an ascending and descending direction.

Calibration Record

A record (e.g., table or graph) of the measured relationship of the transducer output to the applied measurand over the transducer range. Calibration records may contain additional calculated points so identified.

Calibration Traceability

The relation of a transducer calibration, through a specified step-by-step process, to an instrument or group of instruments calibrated by the N.I.S.T.

Calibration Uncertainty

The maximum calculated error in the output values, shown in a calibration record, due to causes not attributable to the transducer.

Compensation

Provision of a supplemental device, circuit, or special materials to counteract known sources of error.

Digital Output

Transducer output that represents the magnitude of the measurand in the form of a series of discrete quantities coded in a system of notation. Distinguished from analog output.

Drift

An undesired change in output over a period of time, which change is not a function of the measurand.

Dynamic Characteristics

Characteristics of a transducer which relate to its response to variations of the measurand with time.

End Points

The outputs at the specified upper and lower limits of the range. Unless otherwise specified, end points are averaged during any one calibration.

Environmental Conditions

Specified external conditions (shock, vibration, temperature, etc.) to which a transducer may be exposed during shipping, storage, handling, and operation.

Environmental Conditions, Operating

Environmental conditions during exposure to which a transducer must perform in some specified manner.

Error

The algebraic difference between the indicated value and the true value of the measurand. It is usually expressed in percent of the full-scale output, sometimes expressed in percent of the output reading of the transducer. A theoretical value may be specified as true value.

Error Band

The band of maximum deviations of output values from a specified reference line or curve due to those causes attributable to the transducer. The band of allowable deviations is usually expressed as "±__ percent of full-scale output," whereas in test and calibration reports, the band of maximum actual deviations is expressed as "+__ percent, -__ percent of full-scale output." The error band should be specified as applicable over at least two calibration cycles, so as to include repeatability, and verified accordingly.

Error Curve

A graphical representation of errors obtained from a specified number of calibration cycles.

Excitation

The external electrical voltage and/or current applied to a transducer for its proper operation. In the sense of a physical quantity to be measured by a transducer, use measurand. Usually expressed as range(s) of voltage and/or current values. Also see Maximum Excitation.

Fluid Temperature Range (see Temperature Range, Fluid)

Frequency, Natural

The frequency of free (not forced) oscillations of the sensing element of a fully assembled transducer. It is also defined as the frequency of a sinusoidally applied measurand at which the transducer output lags the measurand by 90°. Applicable at room temperature unless otherwise specified. Also see Frequency, Resonant and Frequency, Ringing which are considered of more practical value than natural frequency.

Frequency, Resonant

The Measurand frequency at which a transducer responds with maximum output amplitude. When major amplitude peaks occur at more than one frequency, the lowest of these frequencies is the resonant frequency. A peak is considered major when it has an amplitude at least 1.3 times the amplitude of the frequency to which specified frequency response is referred. For subsidiary resonance peaks, see Resonances.

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Frequency Response

The change with frequency of the output measurand amplitude ratio (and of the phase difference between output and measurand), for a sinusoidally varying measurand applied to a transducer within a stated range of measurand frequencies. It is usually specified as “within \pm __ percent (or \pm __ db) from __ to __ Hz.” Frequency response should be referred to a frequency within the specified measurand frequency range and to a specific measurand value.

Full Scale (see range)

Hysteresis

The maximum difference in output, at any measurand value within the specified range, when the value is approached first with increasing and then with decreasing measurand. Hysteresis is expressed in percent of full-scale output, during any one calibration cycle. Friction error is included with hysteresis unless dithering is specified.

Input Impedance

The impedance (presented to the excitation source) measured across the excitation terminals of a transducer. Unless otherwise specified, input impedance is measured at room conditions, with no measurand applied, and with the output terminals open circuited.

Least-Squares Line

The straight line for which the sum of the squares of the residuals (deviations) is minimized.

Least-Square Linearity (see Linearity, Least Squares)

Linearity

The closeness of a calibration curve to a specified straight line. Linearity is expressed as the maximum deviation of any calibration point on a specified straight line, during any one calibration cycle. It is expressed as “within \pm percent of full range output.”

Linearity, End Point

Linearity referred to the end-point line.

Linearity, Independent

Linearity referred to the Best Straight Line.

Linearity, Least Squares

Linearity referred to the least-squares line.

Linearity, Terminal

Linearity referred to the Terminal line.

Load Impedance

The impedance presented to the output terminals of a Transducer by the associated external circuitry.

Maximum (Minimum) Ambient Temperature

The value of the highest (lowest) ambient temperature to which a transducer can be exposed, with or without excitation applied, without being damaged or subsequently showing a performance degradation beyond specified tolerances.

Maximum Excitation

The maximum value of excitation voltage or current that can be applied to the transducer at room conditions without causing damage or performance degradation beyond specified tolerances.

Mean Output Curve

The curve through the mean values of output during any one calibration cycle or a different specified number of calibration cycles.

Measurand

A physical quantity, property or condition which is measured. The term measurand is preferred to “input,” “parameter to be measured,” “physical phenomenon,” “stimulus,” and “variable.”

Mounting Error

The Error resulting from mechanical deformation of the transducer caused by mounting the transducer and making all measurand and electrical connections.

Natural Frequency (see Frequency, Natural Null)

A condition, such as of balance, which results in a minimum absolute value of output.

Operating Environmental Conditions (see Environmental Conditions, Operating)

Operating Temperature Range (see Temperature Range, Operating)

Output

The electrical quantity, produced by a transducer, which is a function of the applied measurand.

Output Impedance

The impedance across the output terminals of a transducer presented by the transducer to the associated external circuitry.

Output Noise

The rms, peak, or peak-to-peak (as specified) AC component of a transducer’s DC output in the absence of measurand variations. Unless otherwise specified, output impedance is measured at room conditions and with the excitation terminals open circuited, except that nominal excitation and measurand between 80 and 100 percent of span is applied when the transducer contains integral active output-conditioning circuitry.

Output Regulation

The change in output due to a change in excitation. Unless otherwise specified, output regulation is measured at room conditions and with the measurand applied at its upper range limit.

Overload

The maximum magnitude of measurand that can be applied to a transducer without causing a change in performance beyond specified tolerance.

Overrange (see Overload)

Precision (see Repeatability and Stability) Range

The measurand values, over which a transducer is intended to measure, specified by their upper and lower limits.

Repeatability

The ability of a transducer to reproduce output readings when the same measurand value is applied to it consecutively, under the same conditions, and in the same direction. Repeatability is expressed as the maximum difference between output readings; it is expressed as “within ___ percent of full-scale output.” Two calibration cycles are used to determine repeatability unless otherwise specified.

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Resolution

The magnitude of output step changes as the measurand is continuously varied over the range. Resolution is best specified as average and maximum resolution; it is usually expressed in percent of full-scale output. In the sense of the smallest detectable change in measurand, use threshold.

Resonant Frequency (see Frequency, Resonant)

Room Conditions

Ambient environmental conditions, under which transducers must commonly operate, which have been established as follows:

- temperature: $25 \pm 10^{\circ}\text{C}$ ($77 \pm 18^{\circ}\text{F}$)
- relative humidity: 90% or less.
- barometric pressure: 26" to 32" of mercury.

Tolerances closer than shown are frequently specified for transducer calibration and test environments.

Sensing Element

That part of the transducer which responds directly to the measurand. This term is preferred to "primary detecting element."

Sensitivity

The ratio of the change in transducer output to a change in the value of the measurand. In the sense of the smallest detectable change in measurand, use threshold.

Sensitivity Shift

A change in the slope of the calibration curve due to a change in sensitivity.

Source Impedance

The impedance of the excitation supply presented to the excitation terminals of the transducer.

Span

The algebraic difference between the limits of the range.

Stability

The ability of a transducer to retain its performance characteristics for a relatively long period of time. Unless otherwise stated, stability is the ability of a transducer to reproduce output readings obtained during its original calibration, at room conditions, for a specified period of time; it is then typically expressed as "within _____ percent of full-scale output for a period of _____ months."

Static Calibration

A calibration performed under room conditions and in the absence of any vibration, shock, or acceleration (unless one of these is the measurand).

Temperature Error Band

The error band applicable over stated environmental temperature limits.

Temperature Gradient Error

The transient deviation in output of a transducer at a given measurand value when the ambient temperature or the measured fluid temperature changes at a specified rate between specified magnitudes.

Temperature Range, Fluid

The range of temperature of the measured fluid, when it is not the ambient fluid, within which operation of the transducer is intended. Within the range of fluid temperature all tolerances specified for temperature error, temperature error band, temperature gradient error, thermal zero shift and thermal sensitivity shift are applicable. When a fluid temperature range is not separately specified, it is intended to be the same as the operating temperature range.

Temperature Range, Operating

The range of ambient temperatures, given by their extremes, within which the transducer is intended to operate. Within this range of ambient temperature, all tolerances specified for temperature error, temperature error band, temperature gradient error, thermal zero shift and thermal sensitivity shift are applicable.

Terminal Line

A Theoretical slope for which the theoretical end points are 0 and 100% of both measurand and output.

Terminal Linearity (see Linearity, Terminal).

Theoretical Curve

The specified relationship (table, graph, or equation) of the transducer output to the applied measurand over the range.

Thermal Sensitivity Shift

The sensitivity shift due to changes of the ambient temperature from room temperature to the specified limits of the operating temperature range.

Thermal Zero Shift

The zero shift due to changes of the ambient temperature from room temperature to the specified limits of the operating temperature range.

Threshold

The smallest change in the measurand that will result in a measurable change in transducer output. When the threshold is influenced by the measurand values, these values must be specified.

Transducer

A device which provides a usable output in response to a specified measurand. The term transducer is usually preferred to "sensor" and "detector" and to such terms as "flow meter," "accelerometer" and tachometer." It is always preferred to "pickup," "gage" (when not equipped with a dial indicator), "transmitter" (which has an entirely different meaning in telemetry technology), "cell," and "end instrument."

Warm-up Period

The period of time, starting with the application of excitation to the transducer, required to assure that the transducer will perform within all specified tolerances.

Zero-Measurand Output

The output of a transducer, under room conditions unless otherwise specified, with nominal excitation and zero measurand applied.

Zero Shift

A change in the zero-measurand output over a specified period of time and at room conditions. This error is characterized by a parallel displacement of the entire calibration curve.