

Load Cell Terms & Definitions

This document defines the terminology and performance parameters pertaining to engineering specifications of load cell products. The objective of this terminology standard is to promote effective communication of specifications and to constitute a reference for uniformity. The definitions herein are generally compatible with common understanding in the load cell community and are an expansion of those found in "Load Cell Terminology and Test Procedure Recommendations," Third Edition, 1985, Scale Manufacturers Association, and in OIML International Recommendation R60, 1991 Edition. This document includes modifications to the definitions in the above referenced standards to correct some of their inconsistencies and inadequacies.

For convenience, terms which are defined in this standard are printed in upper case when used in the definition of another term.

AMBIENT TEMPERATURE

The temperature of the medium surrounding the LOAD CELL.

AXIAL LOAD

A load applied along the PRIMARY AXIS.

BAROMETRIC SENSITIVITY

The change in ZERO BALANCE due to a change in ambient barometric pressure. Normally expressed in units of %RO/atm.

CALIBRATION

The comparison of LOAD CELL OUTPUT against standard test loads.

CAPACITY

The maximum AXIAL LOAD a LOAD CELL is designed to measure within its specifications.

COMBINED ERROR

The maximum deviation of the CALIBRATION curve from the straight line drawn between MINIMUM LOAD OUTPUT and MAXIMUM LOAD OUTPUT, normally expressed in units of %FS. Both ascending and descending curves are considered.

CREEP

The change in LOAD CELL SIGNAL occurring with

time while under load and with all environmental conditions and other variables remaining constant. Normally expressed in units of % of applied load over a specified time interval. It is common for characterization to be measured with a constant load at or near CAPACITY.

CREEP RECOVERY

The change in LOAD CELL SIGNAL occurring with time immediately after removal of a load which had been applied for a specified time interval, environmental conditions and other variables remaining constant during the loaded and unloaded intervals. Normally expressed in units of % of applied load over a specified time interval. Normally the applied interval and the recovery interval are equal. It is common for characterization to be measured with a constant load at or near CAPACITY.

CREEP RETURN

The difference between LOAD CELL SIGNAL immediately after removal of a load which had been applied for a specified time interval, environmental conditions and other variables remaining constant during the loaded interval, and the SIGNAL before application of the load. Normally expressed in units of % of applied load over a specified time interval. It is common for characterization to be measured with a constant load at or near CAPACITY.

DEFLECTION ☑

The displacement of the point of AXIAL LOAD application in the PRIMARY AXIS between the MDL and MDL+CAPACITY load conditions.

ECCENTRIC LOAD

Any load applied parallel to but not concentric with the PRIMARY AXIS.

FULL SCALE or FS

The OUTPUT corresponding to MAXIMUM LOAD in any specific test or application.

HYSTERESIS

The algebraic difference between OUTPUT at a given load descending from MAXIMUM LOAD and OUTPUT at the same load ascending from MINIMUM LOAD. Normally expressed in units of %FS. It is common for characterization to be measured at 40-60% FS.

☑ See APPENDIX articles for more detailed information

INPUT RESISTANCE

The resistance of the LOAD CELL circuit measured at the excitation terminals with no load applied and with the output terminals open-circuited.

INSULATION RESISTANCE

The DC resistance measured between the bridge circuit and the case. Normally measured at 50 VDC.

LOAD CELL

A device which produces an OUTPUT proportional to an applied force load.

MAXIMUM AXIAL LOAD, SAFE

The maximum AXIAL LOAD which can be applied without producing a permanent shift in performance characteristics beyond those specified. Normally expressed in units of % CAPACITY.

MAXIMUM LOAD

The highest load in a specific test or application, which may be any load up to and including CAPACITY + MINIMUM LOAD, but may not exceed CAPACITY significantly.

MAXIMUM AXIAL LOAD, ULTIMATE

The maximum AXIAL LOAD which can be applied without producing a structural failure. Normally expressed in units of % CAPACITY.

MAXIMUM LOAD AXIS MOMENT, SAFE

The maximum moment with respect to the PRIMARY AXIS which can be applied without producing a permanent shift in performance characteristics beyond those specified.

MAXIMUM MOUNTING TORQUE, SAFE

The maximum torque which can be applied concentric with the primary axis without producing a permanent shift in performance characteristics beyond those specified.

MAXIMUM SIDE LOAD, SAFE

The maximum SIDE LOAD which can be applied without producing a permanent shift in performance characteristics beyond those specified.

MEASURING RANGE

The difference between MAXIMUM LOAD and MINIMUM LOAD in a specific test or application. It may not exceed CAPACITY.

MINIMUM DEAD LOAD or MDL

The smallest load for which specified performance will be met. It is normally equal to or near NO LOAD in single mode applications and is of necessity equal to NO LOAD in double mode applications.

MINIMUM LOAD

The lowest load in a specific test or application, differing from NO LOAD by the weight of fixtures and load receptors which are attached plus any intentional pre-load which is applied.

MODE

The direction of load. tension & compression are each one mode.

NATURAL FREQUENCY

The frequency of free oscillations under conditions of NO LOAD.

NO LOAD

The condition of the LOAD CELL when in its normal physical orientation, with no force input applied, and with no fixtures or load receptors attached.

NONLINEARITY

The algebraic difference between OUTPUT at a specific load and the corresponding point on the straight line drawn between MINIMUM LOAD and MAXIMUM LOAD. Normally expressed in units of %FS. It is common for characterization to be measured at 40-60 %FS.

NONREPEATABILITY

The maximum difference between OUTPUT readings for repeated loadings under identical loading and environmental conditions. Normally expressed in units of %RO.

OUTPUT

The algebraic difference between the SIGNAL at applied load and the SIGNAL at MINIMUM LOAD.

OUTPUT RESISTANCE

The resistance of the LOAD CELL circuit measured at the SIGNAL terminals with no load applied and with the excitation terminals open-circuited.

PRIMARY AXIS

The axis along which the LOAD CELL is designed to be loaded.

See APPENDIX articles for more detailed information

Load Cell Terms & Definitions, Continued

RATED OUTPUT or RO

The OUTPUT corresponding to CAPACITY, equal to the algebraic difference between the SIGNAL at (MINIMUM LOAD + CAPACITY) and the SIGNAL at MINIMUM LOAD.

RESOLUTION

The smallest change in load which produces a detectable change in the SIGNAL.

SHUNT CALIBRATION

Electrical simulation of OUTPUT by connection of shunt resistors of known values at appropriate points in the circuitry.

SIDE LOAD

Any load at the point of AXIAL LOAD application acting at 90° to the PRIMARY AXIS.

SIGNAL

The absolute level of the measurable quantity into which a force input is converted.

SPAN

Another name for RATED OUTPUT.

STATIC ERROR BAND or SEB

The band of maximum deviations of the ascending and descending calibration points from a best fit line through zero OUTPUT. It includes the effects of NONLINEARITY, HYSTERESIS, and non-return to MINIMUM LOAD. Normally expressed in units of %FS.

SEB OUTPUT

A computed value for OUTPUT at CAPACITY derived from a line best fit to the actual ascending and descending calibration points and through zero OUTPUT.

SYMMETRY ERROR

The algebraic difference between the RATED OUTPUT in tension and the average of the absolute values of RATED OUTPUT in tension and RATED OUTPUT in compression. Normally expressed in units of %RO.

TEMPERATURE EFFECT ON OUTPUT

The change in OUTPUT due to a change in AMBIENT TEMPERATURE. Normally expressed as the slope of a chord spanning the COMPENSATED TEMPERATURE RANGE and in units of %/°F or %/100°F.

TEMPERATURE EFFECT ON ZERO

The change in ZERO BALANCE due to a change in AMBIENT TEMPERATURE. Normally expressed as the slope of a chord spanning the COMPENSATED TEMPERATURE RANGE and in units of %RO/°F or %RO/100°F.

TEMPERATURE RANGE, COMPENSATED

The range of temperature over which the LOAD CELL is compensated to maintain OUTPUT and ZERO BALANCE within specified limits.

TEMPERATURE RANGE, OPERATING

The extremes of AMBIENT TEMPERATURE within which the LOAD CELL will operate without permanent adverse change to any of its performance characteristics.

TOGGLE

Another name for ZERO FLOAT.

ZERO BALANCE

The SIGNAL of the LOAD CELL in the NO LOAD condition.

ZERO DEAD BAND

Another name for ZERO FLOAT.

ZERO FLOAT

The shift in ZERO BALANCE resulting from a complete cycle of equal tension & compression loads. Normally expressed in units of %FS and usually characterized at FS = CAPACITY.

ZERO STABILITY

The degree to which ZERO BALANCE is maintained over a specified period of time with all environmental conditions, loading history, and other variables remaining constant.

See APPENDIX articles for more detailed information

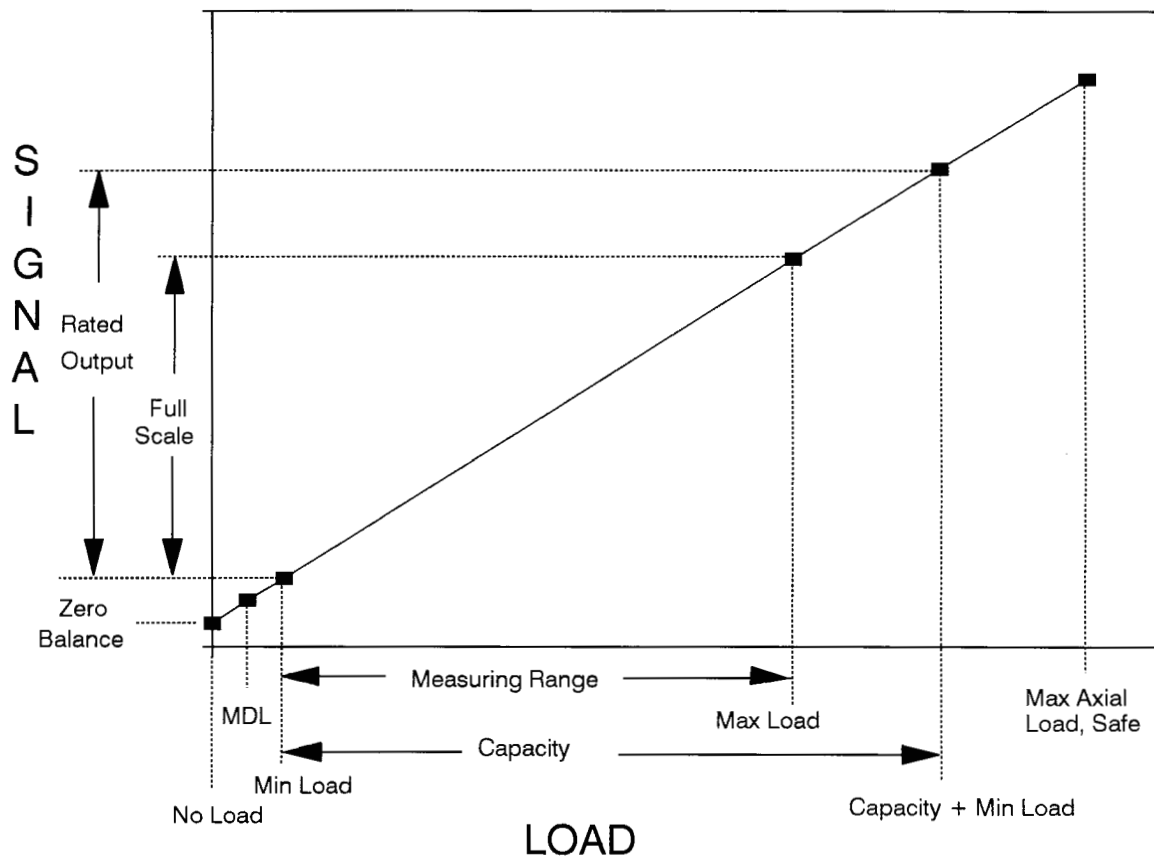


FIGURE 1. ILLUSTRATION OF TERMS

ABBREVIATIONS

(All abbreviations are case-specific, are not to be pluralized, and do not use trailing periods.)

ampere	A	kilogram force	kgf	pound	lb
combined error	CE	kilonewton	kN	pound-inch	lb-in
degree Celsius	°C	kilopound (kip)	K	pound-foot	lb-ft
degree Fahrenheit	°F	kilopound force	K lbf	pound force	lbf
degree Kelvin	°K	meganewton	MN	pound per square inch	psi
foot	ft	meter	m	rated output	RO
foot-pound	ft-lb	milliamper	mA	static error band	SEB
full scale	FS	millimeter	mm	ton, metric	t
gram	g	millivolt	mV	volt	V
hertz	Hz	millivolt/volt	mV/V	volt direct current	VDC
inch	in	minimum dead load	MDL	volt alternating current	VAC
inch-pound	in-lb	newton	N	watt	W
kilogram	kg	newton-meter	Nm		