Load-cell calibration report

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Introduction

The goal of this analysis is to determine the calibration equation and sensor accuracy for an Omega LCL-005 (0–5 lb) load cell.

The test setup is illustrated in Figure 1. Precision weights (0.1% accuracy) are used to apply the reference force (lb) to the load cell and the resulting voltage readings (mV) from the sensor are recorded. The test procedure follows the ANSI/ISA standard (*Process Instrumentation Terminology* 1995).

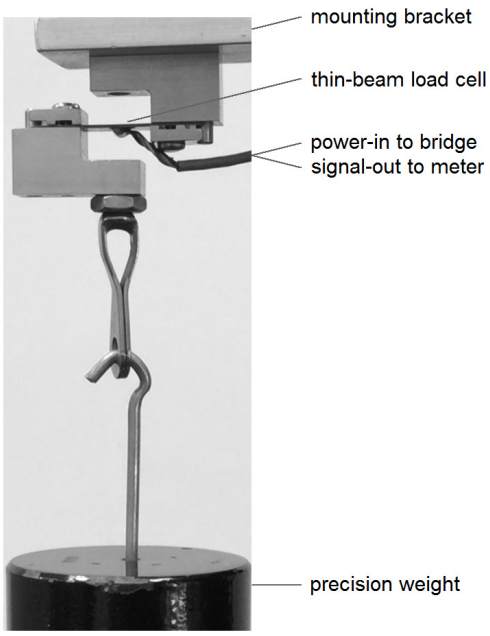

Figure 1. Load cell calibration test setup

Data

The calibration data are shown in Table 1. The maximum force (4.5 lb) is 90% of the 5 lb sensor limit, per the ANSI/ISA standard. The NA entries in the first and last columns are artifacts of the ANSI/ISA test procedure (the test starts and stops at a mid-range test point in the same direction).

Table 1. Calibration data

Input (lb)	Cycle 1 (mV)	Cycle 2 (mV)	Cycle 3 (mV)	Cycle 4 (mV)	Cycle 5 (mV)	Cycle 6 (mV)
1.5	NA	29.9	30.2	29.5	30.7	30.7
2.5	51.1	49.4	49.7	49.6	48.5	51.6
3.5	70.4	70.0	70.1	70.7	71.0	NA
4.5	88.8	91.6	89.5	91.4	91.2	NA
3.5	69.4	69.0	68.5	68.6	70.8	NA
2.5	49.5	50.1	49.8	49.2	50.6	NA
1.5	30.7	30.8	29.2	28.5	30.0	NA
0.5	8.7	10.9	10.6	10.7	9.5	NA

Results

The calibration data and calibration curve are shown in Figure 2. The maximum ± deviations of the data from the best-fit curve (residuals) are the values used to estimate sensor accuracy.

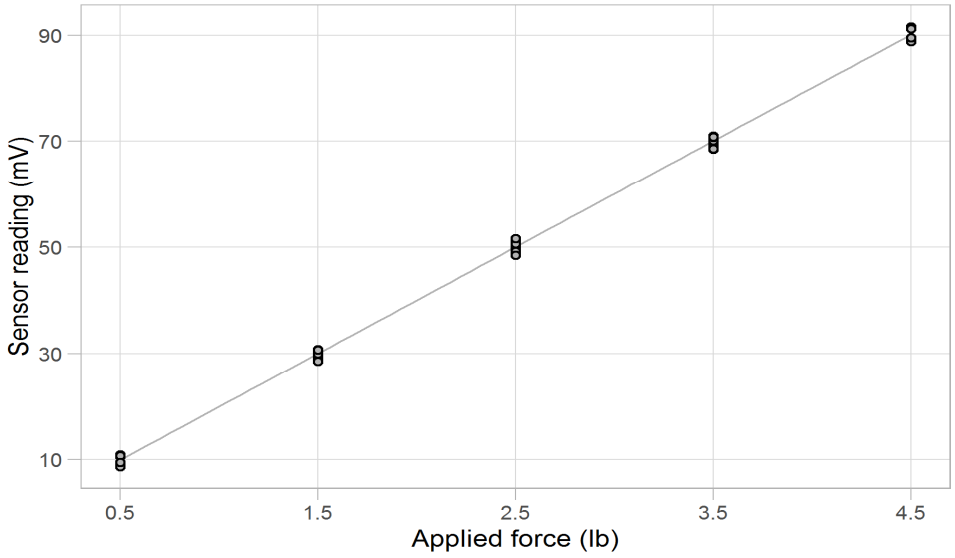

Figure 2. Load cell calibration curve

The calibration equation is

$$y = 20.042x - 0.087$$

with x in lb, y (and the y-intercept) in mV, and the slope in mV/lb.

The largest residual is 1.6 mV and the output span is 82.9 mV, yielding a sensor accuracy as a percent of reading of

$$\pm 2.0\%.$$

The accuracy of the precision weights, 0.1%, is less than one tenth the load cell accuracy, thereby meeting the requirements of the ANSI/ISA standard.(Gandrud 2015)

References

Gandrud, Christopher. 2015. *Reproducible Research with R and RStudio*. 2nd ed. Boca Raton, FL: CRC Press.

Process Instrumentation Terminology. 1995. ANSI/ISA-S51.1-1979, reaffirmed 1995. Research Triangle Park, NC: Instrument Society of America.