

Don't call the Nobel Committee just yet: We forgot to calibrate the instruments before the experiment...

CartoonCollections.com

Calibration
John R. Leeman
8/3/21

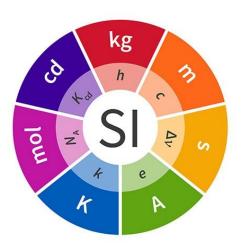


Image: Fluke

## Calibration ensures we translate the measured parameter into the correct real-world approximation of reality







"In short, if measurement results matter, calibration matters."



#### Calibrations are not forever and should be updated frequently



- New sensor
- Repair or modification of apparatus
- Moving apparatus
- After a shock/temperature/load anomaly
- Elapsed time (calibration schedule)
- Elapsed on time (100 hour inspections)
- Before/after critical measurements
- Questionable output
- Output not matching sister instruments
- Requirements (legal or standards)



## In the lab we often utilize a transfer standard to calibration our "field" instruments or instruments with a traceable calibration



CONSULTING & INSTRUMENTATION



#### CALIBRATION RECORD

10 Industrial Drive, P.O.Box 338, Ellington, CT 06029 Tel. (860) 872-8351 Fax (860) 872-4211

#### MODEL NUMBER: 0245-00000

SERIAL # D-217081

Sensitivity: 0.3559 VDC / inch(es) / Volt Input Maximum Non-linearity: 0.2804% F.S. Calculation Method: Best Fit Line Thru Zero Calculated Line: Y = 8.5935 X + 0.0000 Min: 0.31 Max: 0.38 < 0.5% F.S.

Working Range: ±2 inches

Tested at: 24.0110817 VDC Input and > 1 Megaohm Output Load

If the core is not permanently attached to the extension rod, then the transducer was calibrated with the core's marked end towards the transducer's lead end.

#### CALIBRATION DATA:

POSITION	OUT	ERROR	
inch(es)	Data	Zero Adjusted	% F.S.
-2.0000	-17.1425	-17.1399	-0.1378
-1.6000	-13.7898	-13.7872	0.1096
-1.2000	-10.4108	-10.4082	0.2803
-0.8000	-6.9661	-6.9635	0.2590
-0.4000	-3.4911	-3.4885	0.1492
0.0000	-0.0026	0.0000	0.0000
0.4000	3.4880	3.4906	0.1554
0.8000	6.9342	6.9368	0.1810
1.2000	10.3569	10.3595	0.1380
1.6000	13.7302	13.7328	-0.0493
	17.0885	17.0911	-0.2804



Calibrated by: Date: 04/15/2021

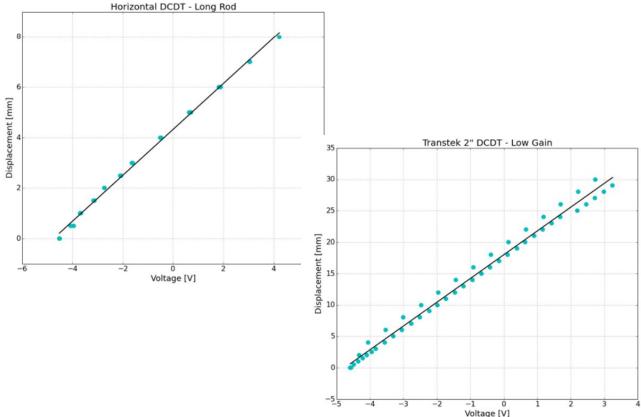
NOTE: Please refer to attached bulletin for additional information CALIBRATION NOTE: BATCH CODE #210415I100603

# We take the transducer to known conditions (controlling everything else as best we can) and record the output



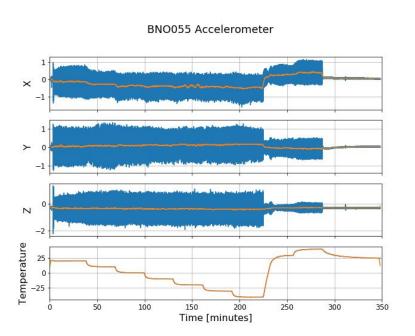


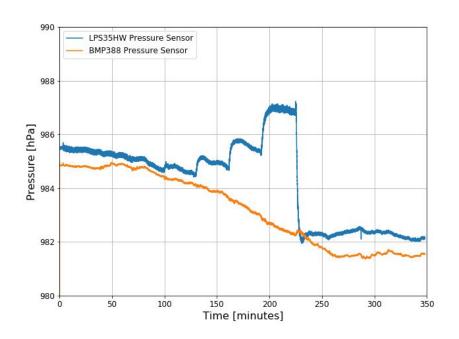
### We can then fit a transfer function and accept or reject the result





### The biggest thing to remember is cross-sensitivity issues!



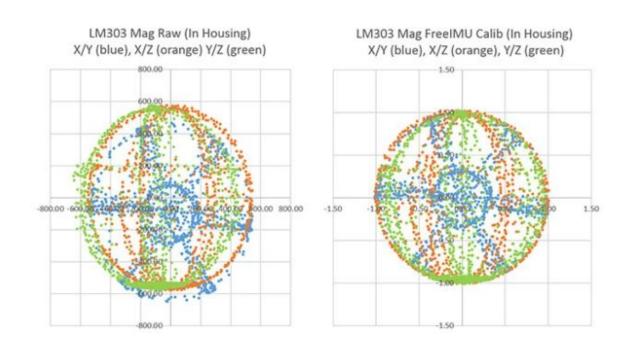


"Everything is a temperature sensor, some things sense other stuff too" - Elecia White



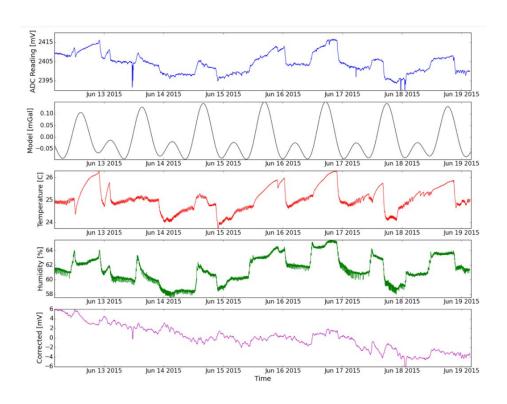
### You can also calibrate things to more natural sources







#### Lots of variables to think about/control



- Temperature
- Humidity
- Pressure
- Orientation
- Time of day
- Traffic/Noise Sources
- Tides
- And on and on



#### Our recommendations for general equipment

- ASTM if available (just have a procedure recorded)
- Semiannual for first 3 years, annual afterwards
- Before any critical experiment (time vs time cost)
- Against NIST traceable standard (which needs calibrated) or by a lab



## Keep a calibration history log in great detail

44 mm Solid "V"	100 100	44mm Solid "H"		62mm "V"		62mm "H"	
10.94 mV/kN	12/10/2009	HG 111.366 mV/kN	3/27/2009	17.82 mV/kN	3/27/2009	HG 173.877 mV/kN	3/27/2009
11.33 mV/kN	1/5/2010	LG 11.58 mV/kN	3/27/2009	18.52 mV/kN	1/5/2010	LG 18.08 mV/kN	3/27/2009
11.15 mV/kN	12/5/2010	HG 110.212 mV/kN	12/10/2009	18.10 mV/kN	1/10/2011	HG 207.152 mV/kN	1/5/2010
10.869606 mV/kN	2/5/2014	LG 11.46 mV/kN	12/10/2009	18.462238 mV/kN	2/5/2014	LG 21.54 mV/kN	1/5/2010
10.829 mV/kN	8/29/2014	HG 114.473 mV/kN	1/7/2011	18.523 mV/kN	8/29/2014	HG 196.333 mV/kN	1/7/2011
10.786349 mV/kN 2/10/2015	LG 11.90 mV/kN	1/7/2011	18.363185 mV/kN	2/10/2015	LG 20.415 mV/kN	1/7/2011	
	HG 108.604244	2/5/2014			HG 200.497461 mV/kN	2/5/2014	
	LG 11.588748	2/5/2014			LG 20.939407 mV/kN	2/5/2014	
	HG 108.71 mV/kN	5/11/2014			HG 208.905 mV/kN	8/29/2014	
	LG 11.315 mV/kN	5/11/2014			LG 21.789 mV/kN	8/29/2014	
	HG 106.08 mV/kN	8/1/2014			HG 211.236884 mV/kN	2/10/2015	
		LG 11.473 mV/kN	8/1/2014			LG 21.393971 mV/kN	2/10/2015
		HG 111.453 mV/kN	8/29/2014			CELL REBUILT	
		LG 11.658 mV/kN	8/29/2014			HG 184.014209 mV/kN	3/6/2015
		HG 119.423363 mV/kN	2/10/2015			LG 18.721994 mV/kN	3/6/2015
		LG 11.742750 mV/kN	2/10/2015				

