

## Fixing irregular batch weights at a food processor

### Using waveform analysis

### Application Note



### Testing Functions Case Study

A vessel on three load cells is filled from a hopper above with around 1500 pounds of grain, depending on the recipe. The slide gate metering the grain is controlled by a PLC-5 based on weight read from the scale terminal. The vessel pressurizes and the grain is forced out the bottom into a transport pipe, sending the grain across the building to processing. When empty, a blower purges the line.

We were getting irregular batch weights. The weight indicated on a Wonderware terminal would occasionally jump low. The weight shown on the scale display was stable. The 4-20mA signal from the scale to the PLC seemed stable with a Fluke 179 Digital Multimeter. Another signal connected to the same channel seemed stable, but that was done with the system idle. Another channel then another input module was tried. Any problem could not readily be seen looking at raw data in RS Logix.

I requested and got the CS20MA for my new toy, the Fluke 199B ScopeMeter® test tool. I connected in series and recorded a batch. The first batch recorded showed no obvious signs of trouble. Filling and discharging weight seemed smooth although the empty current was a little low.

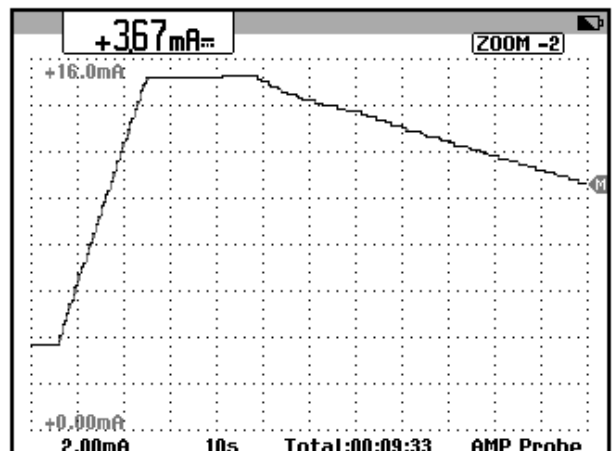
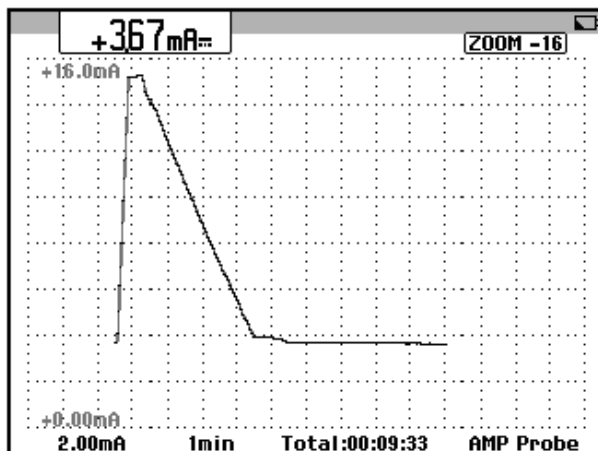
### Seen below

The slide gate opens, the scale fills, the slide gate closes. After stabilizing, the gate cycles one more short time to top off the batch. Compressed air empties the scale.

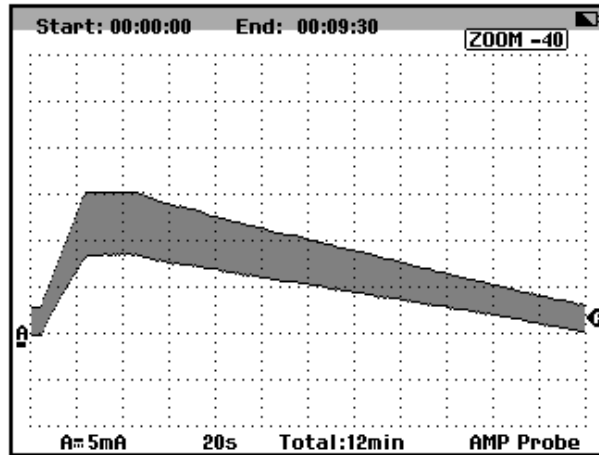
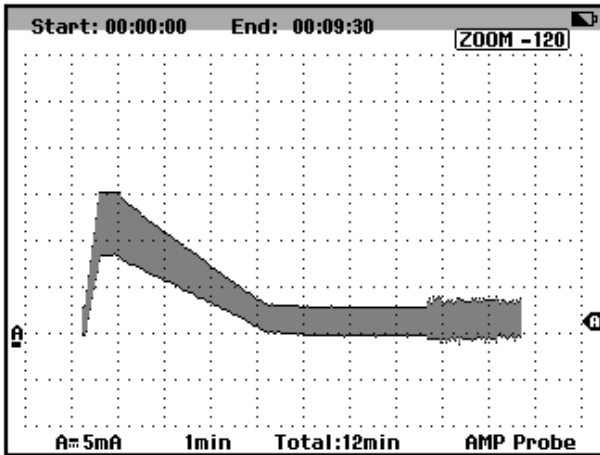
**Tool:** 199B/S ScopeMeter® Test Tool

**Operator:** Instrumentation technician using a Mettler Toledo 8510 industrial scale

**Measurements:** Weighing and dense phase conveying of batches of grain

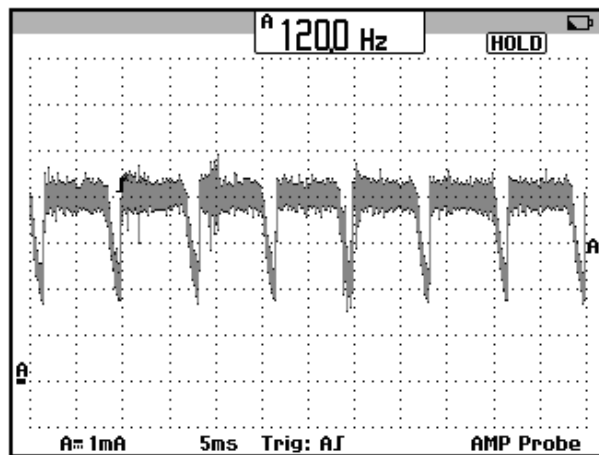
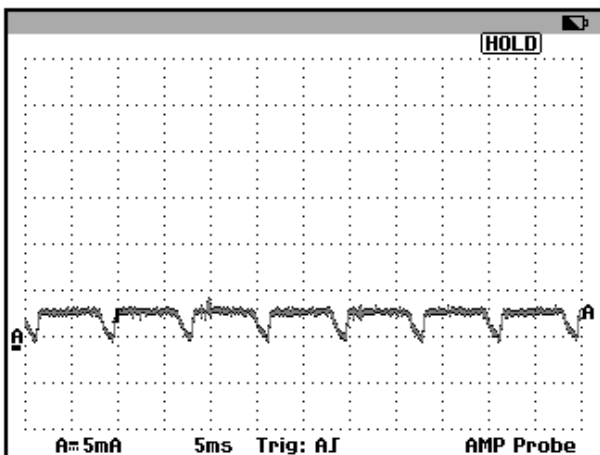
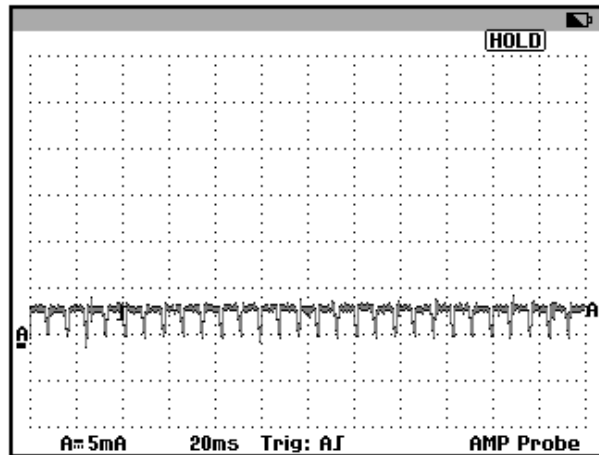
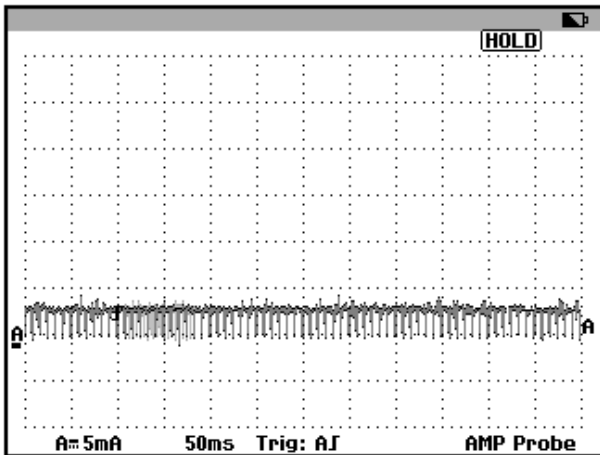


**The next batch was a scope record:**



That sure didn't look right. The noise at the end is the blower running but why was the signal 3-7mA thick?

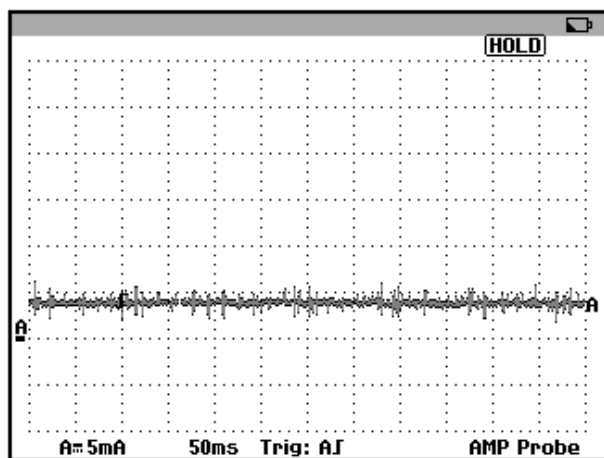
**Zooming in on the noise:**



The frequency measuring feature saved me some math. After seeing the dips at 120 Hz, I was sure there was a bad capacitor after a bridge rectifier somewhere.

I consulted the scale manual. The interconnect diagrams on pages 58-59 showed me that the analog output module on the back of the scale got 120 V ac in and the loop power originated on board. Page 55 shows the analog board. C8 and C10 are 470  $\mu$ F 35 V. C9 between them is 47  $\mu$ F 25 V. Radio Shack actually stocked these caps in 35 V. The 47  $\mu$ F C9 was the culprit. I replaced all three caps for four bucks.

**Here's the clean signal with new caps**



When the PLC sampled the analog data, some data reads would be in the dips, giving us erroneous readings.

**The Fluke ScopeMeter made this easy to find.**

**Fluke.** *Keeping your world up and running.*®

**Fluke Corporation**  
PO Box 9090, Everett, WA 98206 U.S.A.

**Fluke Europe B.V.**  
PO Box 1186, 5602 BD  
Eindhoven, The Netherlands

**For more information call:**  
In the U.S.A. (800) 443-5853 or  
Fax (425) 446-5116  
In Europe/M-East/Africa +31 (0) 40 2675 200 or  
Fax +31 (0) 40 2675 222  
In Canada (800)-36-FLUKE or  
Fax (905) 890-6866  
From other countries +1 (425) 446-5500 or  
Fax +1 (425) 446-5116  
Web access: <http://www.fluke.com>

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