Tests from 10-27-2017: Finding Encoder Velocity Issues

Test Setup

All tests done with an unloaded 50:1 motor. With the following gains:

- Velocity gains:
  - P: 100 * 2^12,
  - I: 512 * 2^12
- Current gains (N/A for no current):
  - P: 32 * 2^12,
  - I: 640 * 2^12

Most of the tests are run with the:

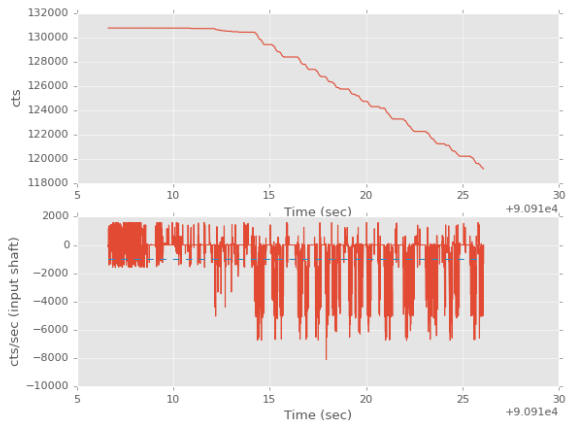
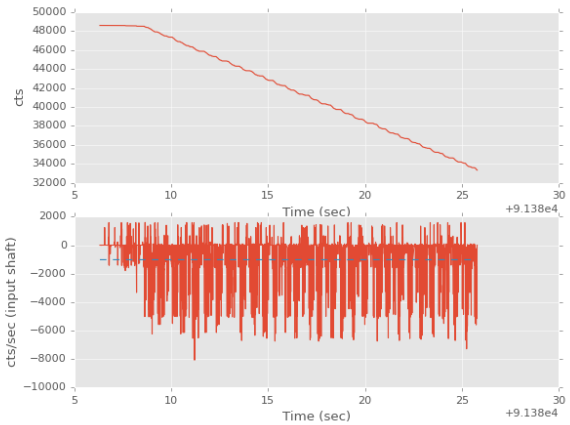
- w/ current firmware (`r141`)
- w/o current firmware (`no_current_test_001`)

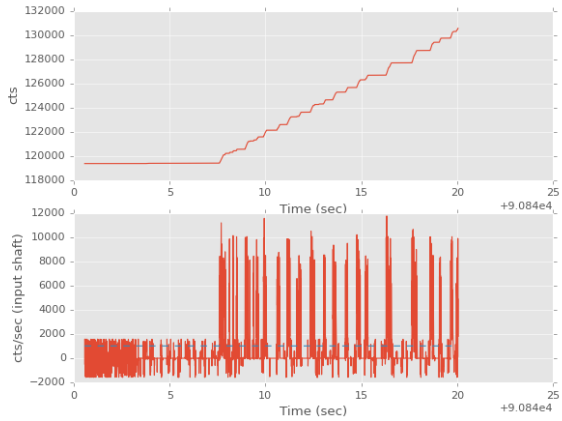
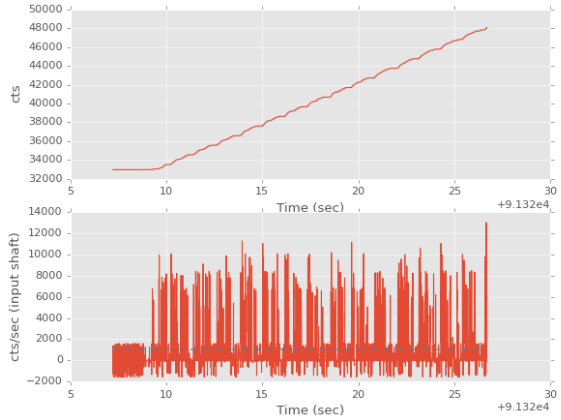
In all graphs the blue dotted line is the target velocity, the top graph is position and the bottom graph is velocity. (as the units indicate).

All data was taken over `canopen` with a sync period of `.004`.

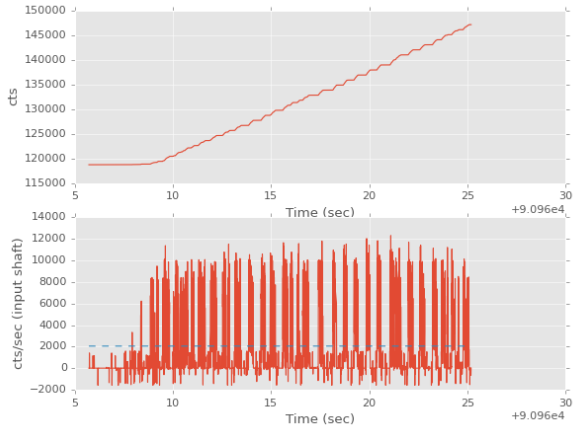
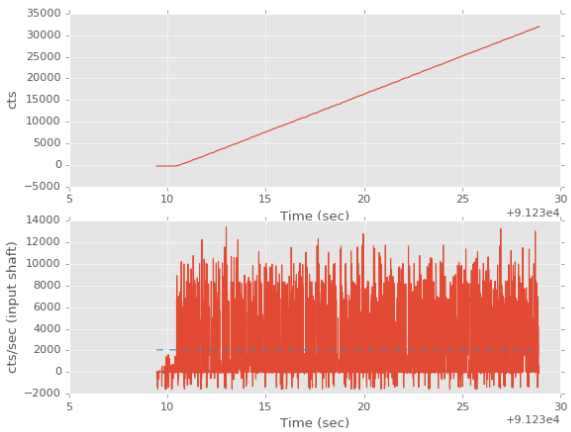
Test Results

First I ran the motor at 1024 cts/second (one revolution per second at the input shaft). The results are similar for positive and negative rotation.

Negative 1024 cts / second (w/o current)	Negative 1024 cts / second (w/ current)
	

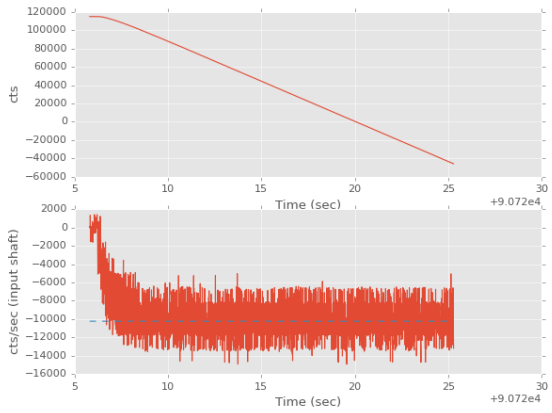
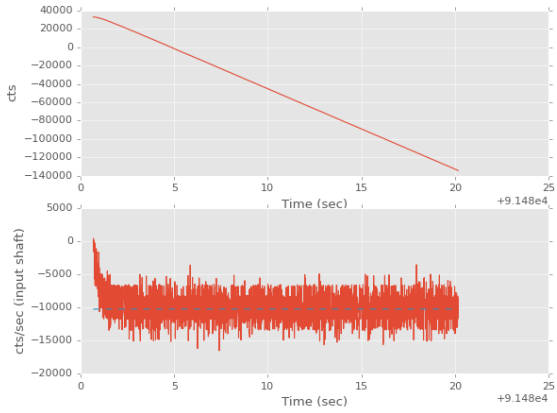
Positive 1024 cts / second (w/o current)	Positive 1024 cts / second (w/ current)
	

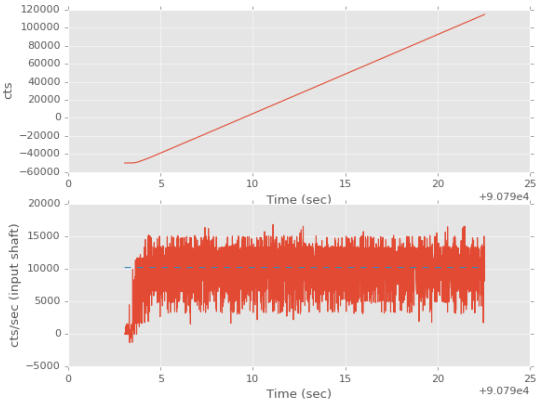
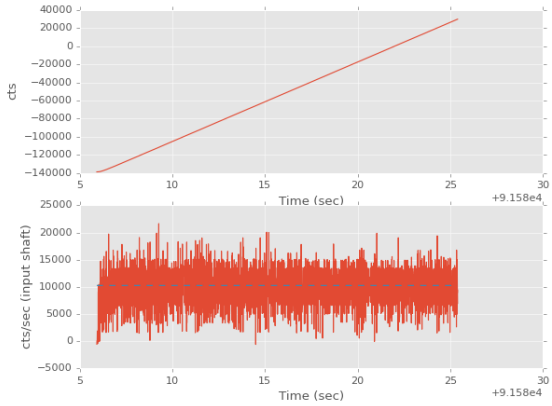
I then doubled the speed with similar results.

Positive 2048 cts / second (w/o current)	Positive 2048 cts / second (w/ current)
	

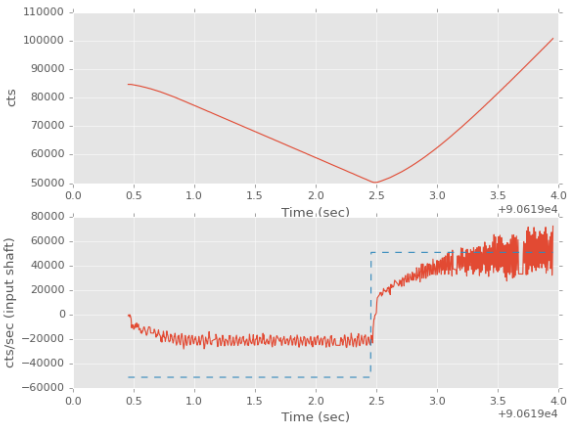
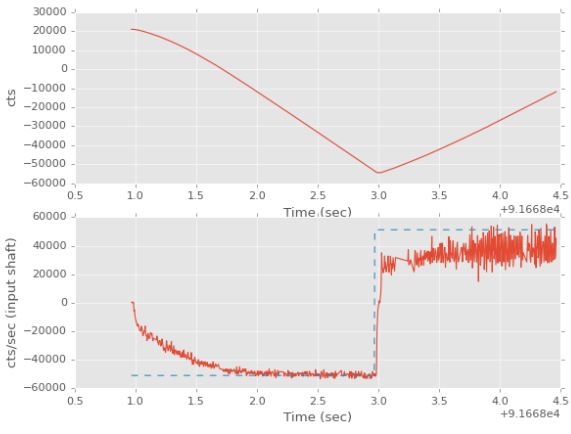
At around 10x1024 cts / second (.2 Rotations / Second at the output shaft) the erratic motion is less noticable, but the velocity noise is still high.

Negative .1 RPS (w/o current)	Negative .1 RPS (w/ current)

Negative .1 RPS (w/o current)	Negative .1 RPS (w/ current)
	

Positive .1 rps (w/o current)	Positive .1 rps (w/ current)
	

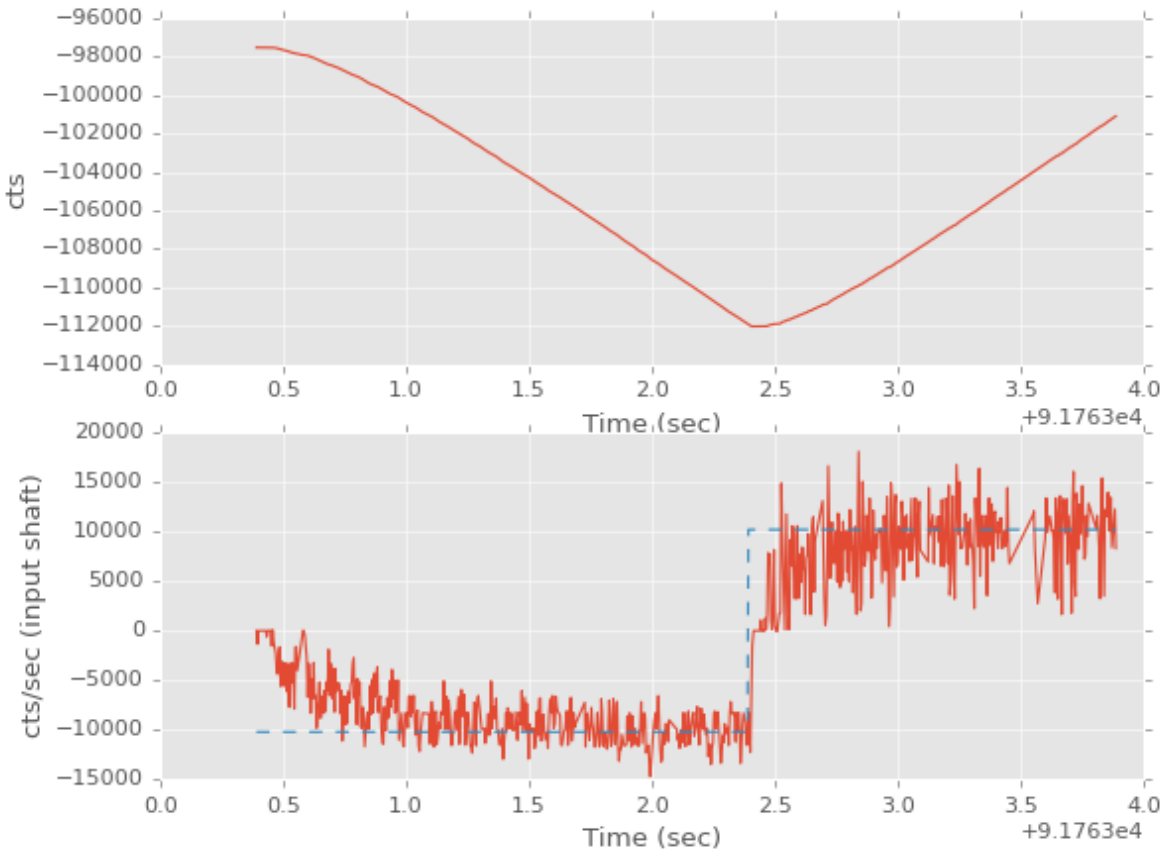
At around 50x1024 cts / second (1 rotation / second at the output shaft) the erratic motion was not present, but some assymetry between the positive and negative going signals was. This is worse without current, but this may be due to incorrect tuning parameters somewhere along the way.

Postive 1 rps to negative 1 rps (w/o current)	1 rps to negative 1 rps (w/ current)
	

Similar results for .1 rps and 2 rps (both w/ current)

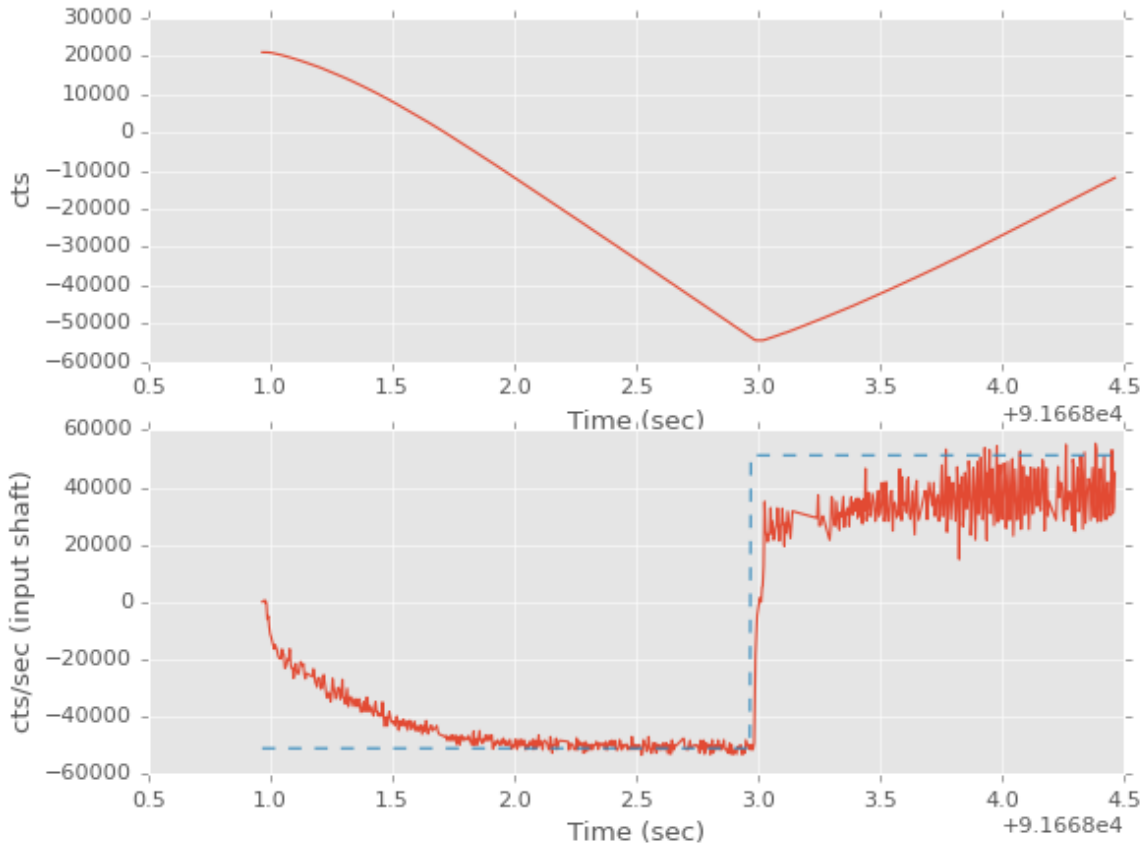
Positive .1 rps to negative .1 rps (w/ current)

Positive .1 rps to negative .1 rps (w/ current)



Positive 2 rps to negative 2 rps (w/ current)

Positive 2 rps to negative 2 rps (w/ current)



Conclusions

1. There are some issues with the encoder ticks and the encoder noise in general. This is most noticable at 0 and low velocities. This is likely related to some of the control problems we see in position mode or when running a position controller since a lot of time can be spent in this regime when holding position.
2. There is some assymetry between positive and negative going velocities.
3. Velocity following error

Video

Video of 1024 cts per second motion (https://drive.google.com/file/d/19eSy0PCIBzzbdsLWZAOfMUfPW14z43xmqQ/view?usp=sharing)