Spring Compensation

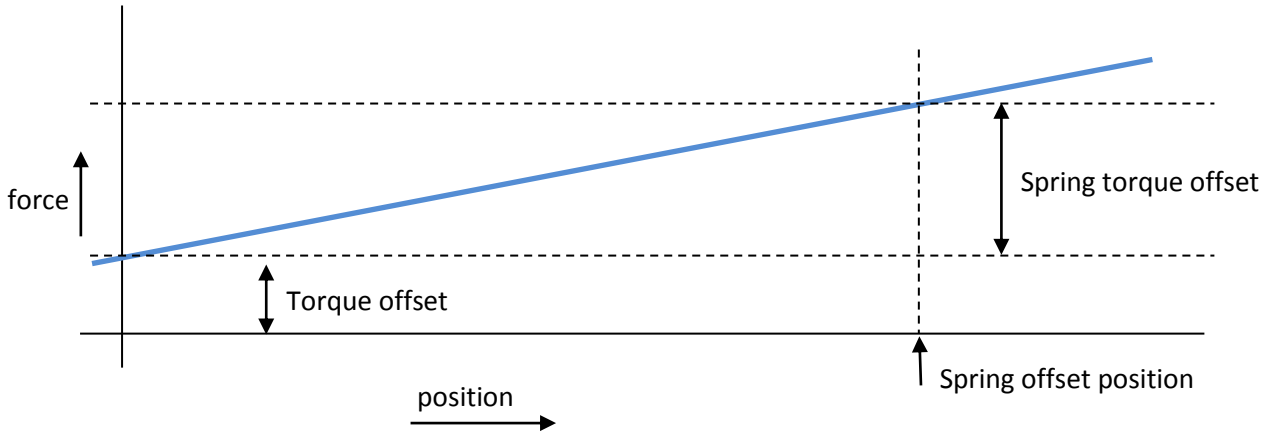
What is spring compensation?

A spring provides a force that behaves linear to the position. Spring compensation is a set of parameters that allows you to compensate the forces of the spring within the current loop. This takes care that the effect of a spring does not influence the position control loop. This makes stability and accurate movement over the full stroke easier.

Spring compensation is only available if you use firmware 2.0 and LCC control center 2.0

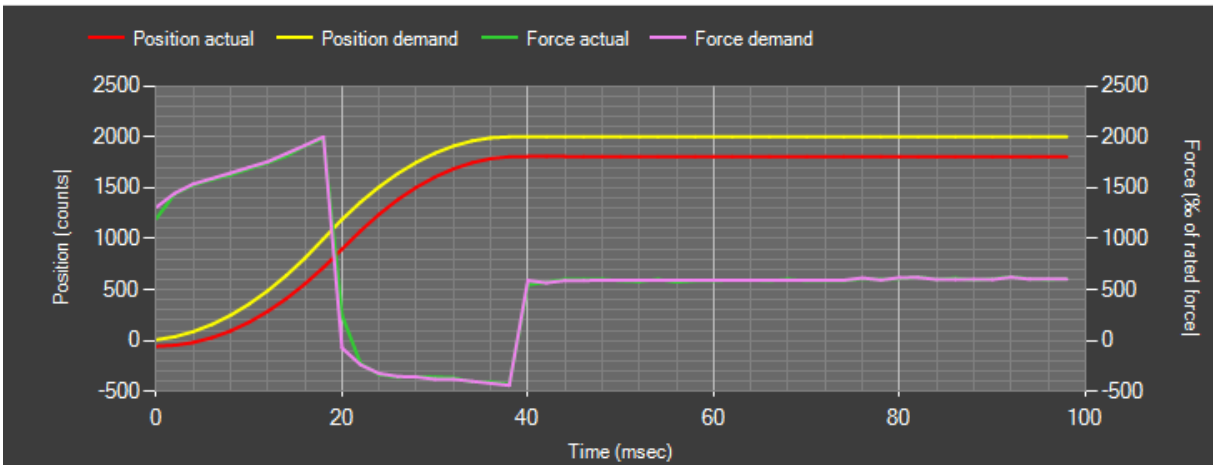
Spring Compensation parameters

The spring compensation requires 3 parameters: **Force offset** (0x60B2), **Spring offset position** (0x22508) and **Spring torque offset** (0x12508). If you look at the force position plot of an actuator the compensation parameters are defined as shown in the plot below.

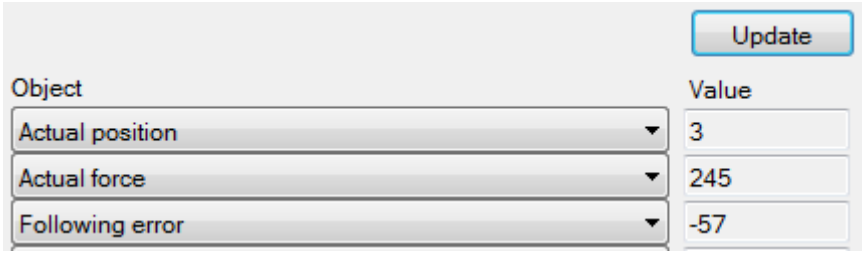


Implement Spring Compensation.

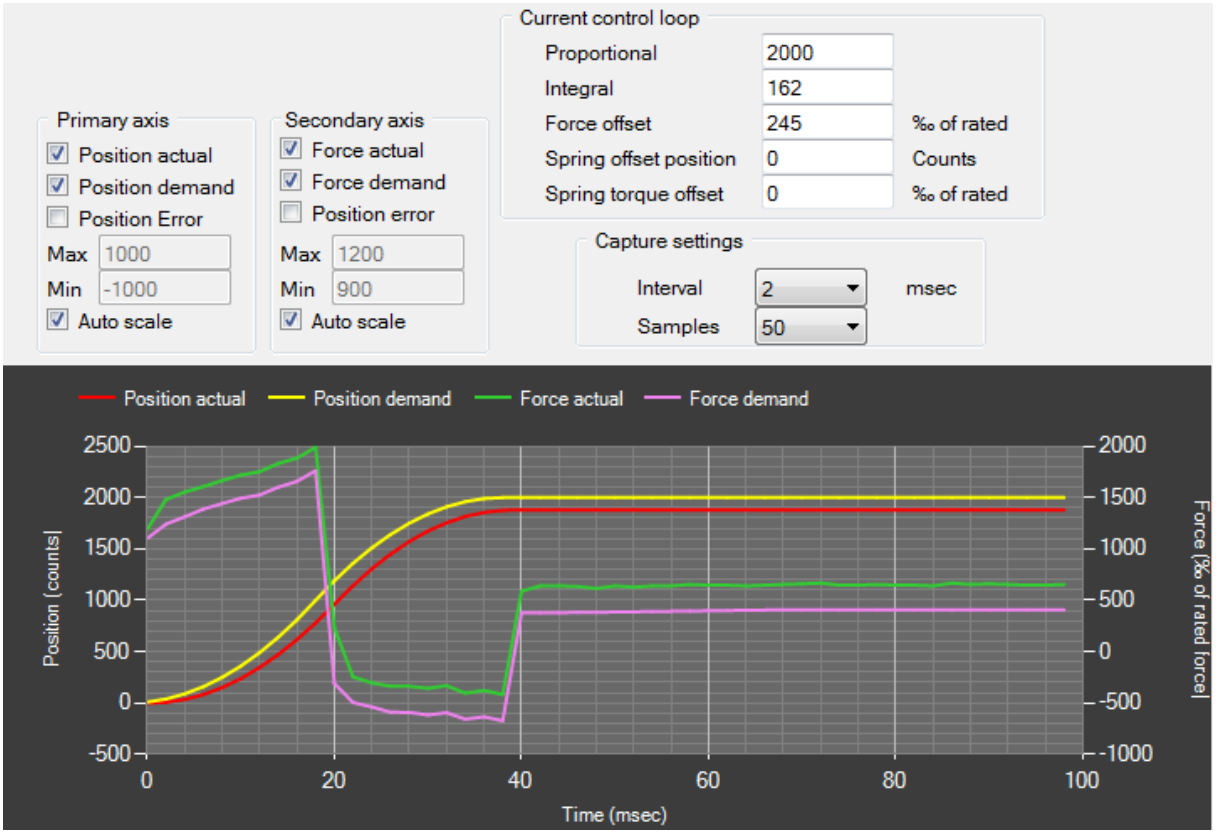
If we take an actuator with a spring return, connect it to the LCC controller and tune it the result could very well look like the image below.



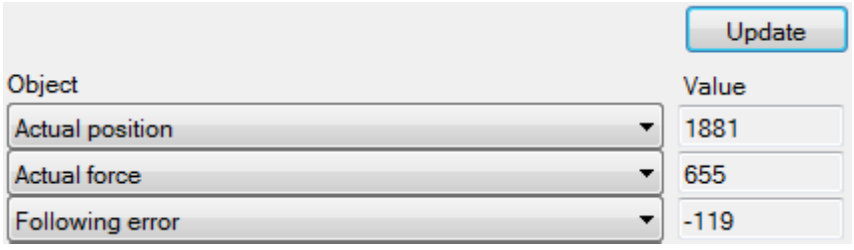
Bring the actuator controlled back to the position zero and read the force required. Use the tuning profile to do this (you might need to set the target to a different value in order to reach position 0, in the example below we moved to target 60 and reached position 3, which is close enough). Then read the actual position in the Run Programs tab:



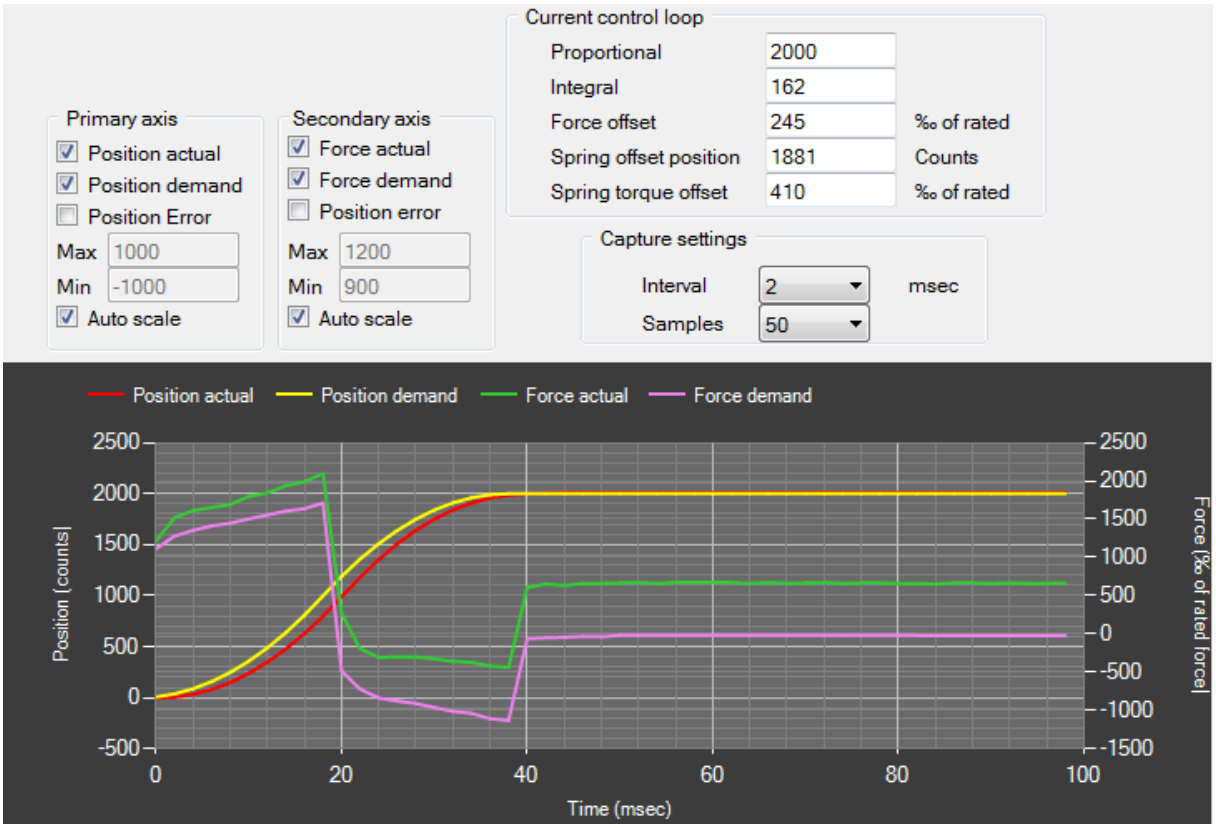
Enter the force value 245 into the Force offset field of the Tuning tab as shown in the next image and run the test trajectory again.



Then have a look at the run programs tab again and check the position and force.



Enter the actual position value 1881 into the **Spring offset position** of the Tuning tab. Take the actual force value (655), subtract the **Force offset** (245) and write the result (410) into the **Spring torque offset** as shown in the next image. When you run the test trajectory again you have compensated for the spring:



The result is a much lower following error at all positions. This allows lower integrator gain for the position loop resulting in less overshoot. Note that when moving in force mode the actual force generated by the coil of the actuator is also proportional to the position. So in force mode you will not feel the effect of the spring at the shaft/slide of the actuator.