Velocity Transducer Improves Pipette Puller Design

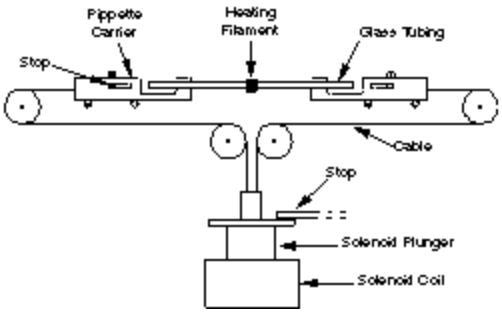
Trans-Tek Series 100 Linear Velocity Transducers are based on the principle of magnetic induction and provide accurate velocity measurement in a linear motion. Passing a magnet through the coil form generates a voltage proportional to the magnet's velocity and field strength. This output signal is used to carefully monitor the speed of moving components in numerous applications.

A reknkowned laboaratory instrument manufacturer has incorporated the Trans-Tek Model 0100-0009 LVT (a slightly modified version of the standard Model 0100-0000) for velocity feedback in their micropipette puller, a device used for the fabrication of micropipettes, patch pipettes and microinjection needles. Taking advantage of the continuous output from this sensor resulted in a superior product design by controlling the tip-forming process for each pipette.

In redesigning the puller to manufacture improved micropipettes, the goal facing Sutter engineers was to increase the rapidity of taper, or, in other words, increase the cone angle at the end of each pipette. Forces of surface tension around the capillary tube cause it to attenuate as it is heated and pulled. While being drawn out over any given length, a slower pull provides more time for surface tension to act, thereby increasing the rapidity of taper. It was thus determined that increasing the cone angle would require a lowered *tip velocity*, defined as the pulling velocity during tip formation.

As part of the enhanced design, a preset pulling velocity, referred to as the *criterion velocity*, was established for the device. This value was determined as the ideal point at which the pull velocity increases just enough to reduce the rapidity of taper. The pulling cycle is then terminated when this condition is achieved. The LVT is mounted on the Solenoid Plunger to monitor the velocity of its fall during the weak pull. The output voltage of the LVT is then fed into an on-board microprocessor to control the pulling cycle after the preset *criterion velocity* (expressed in the circuitry as voltage) is attained.

When considering various design upgrades, linear position feedback was also considered for controlling the pulling cycle. Traditionally, a criterion distance controls the length of time during which heat is delivered, thus determining the temperature and viscosity of the glass. Since the pulling velocity is directly and strongly influenced by the viscosity of the glass, it was apparent that a velocity sensor would offer distinct advantages. As a result, Trans-Tek provided the perfect solution with the Series 100 LVT.



With no excitation voltage required and the DC voltage output varying only with the movement of the magnet, the Linear Velocity Transducer is a very simple device to use. Companies such as Sutter Instrument, therefore, are able to integrate this sensor into their product with little difficulty, reaping the rewards of better performance and increased reliability.