# Southwestern Industries, Inc.
## White Paper

**December 23, 2009**

# Why the TRAK LPM Does Not Use a Counter Weight

All of Southwestern Industries' tool room TRAK bed mills come equipped with a counter weight to balance the weight of the head/ram. The TRAK LPM does not. There are two primary reasons for this design difference.

First, our tool room bed mills use a brush servo motor to drive the head/ram up and down (as well as X and Y). This type of motor is very economical and reliable but is limited in its available torque, horsepower and speed. The use of a counter weight minimizes the torque required lift the head/ram so that a smaller motor is sufficient. The added counter weight increases the system inertia but this is not particularly troublesome in a tool room application.

The TRAK LPM uses brushless servo motors to drive the head/ram up and down (as well as X and Y). This style of motor is readily available in larger torque/horsepower/speed ranges than brush motors and they are smaller relative to their output. The performance of the TRAK LPM requires a brushless motor anyway so it is more sensible for the TRAK LPM to use a somewhat larger motor capable of lifting the head/ram as well as overcoming its friction and inertia than to use a counter weight.

The second primary reason to eliminate the counter weight concerns the sophistication of the motion control system. When a counter weight is used the force to push the head/ram up is about the same as that required to pull it down. The system is balanced. This means that the servo algorithms (the mathematical formulas that control the servo system) and parameters are the same for up and down motion. This is also true for X and Y because moving the table right is the same as moving it left. Our tool room mill controls, the ProtoTRAK SMX and EMX, are less sophisticated (and lower cost) than the TRAK LPM ProtoTRAK PMX control. It is a more advanced control with more computing power and a more sophisticated motion control servo system that can easily deal with the imbalance of up versus down motion of the head/ram.

It should also be noted that for safety as well as performance reasons the TRAK LPM motor driving the head/ram is equipped with a brake that prevents the head from moving when it is not supposed to, even when the power is off.

In summary, the use of a counter weight is not better or worse than not having one. Counter weights allow machines to use smaller motors and less sophisticated motion control servo systems.  But for machines that require larger motors and better motion control servo systems for speed, power and performance – as does the TRAK LPM – then there is no reason to have a counter weight.