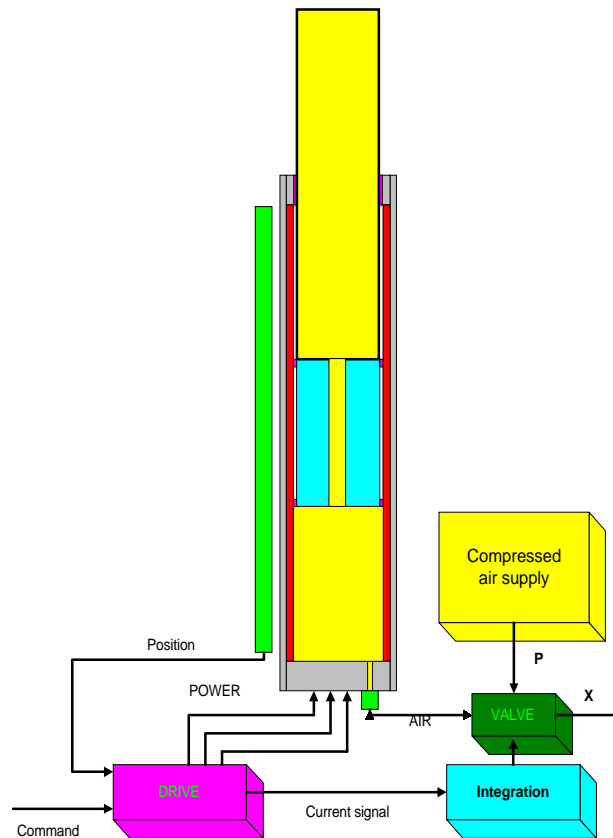


Notes on the use of electromagnetic rams in motion bases



Each motion base actuator consists of a ram with a hollow thrust tube, fixed to a permanent magnet armature that moves within a polished liner that acts as a bearing surface. The liner is surrounded by a series of copper coils that are connected to form three control phases and the unit is hermetically sealed by a ring that bears upon the outer polished surface of the thrust tube where it leaves the stator cylinder.

The armature consists of a stack of magnet rings and polepieces that project a strong magnetic field outwards through the electrical coils; the magnetic flux returning via the outer steel tube that completes the assembly. There are no external electric or magnetic fields.

The deadload of the simulator capsule and its occupants is supported by gas (air) within the actuators, at a pressure of approximately 3 bar (40-50psig). The exact value of this pressure is automatically adjusted. The gas spring pressure is controlled according to a simple algorithm that monitors the current demand by the actuator ram, thus compensating automatically for temperature changes, leaks, load changes and unusual motions of the simulator. Air is not consumed during normal operation of the simulator and it is conserved during standby.

Advantages of electromagnetic motion systems

- **Silent, all electronic** system
- No Hydraulics - no mess, no cooling, no pumps or high-pressure pipes
- No ballscrews – no noise, no wear, no windup or slow response
- Inherent force sensing allows body motion interaction
- Simple, wide-tolerance, robust mechanical design
- Fully sealed (waterproof) machinery
- Very low maintenance requirement
- Off-the-shelf power units and controllers

- **Unsurpassable performance** – an order of magnitude better than the best hydraulic system
- Faster, smoother and more precise response
- Self-contained and fully-automatic counterbalancing
- High power efficiency through patented design features

- **Important safety features:-**
 1. Continuous gas spring tuning minimises electrical power demand, eliminates any cooling requirement and copes with severe overloading and abuse.
 2. Under power fail conditions the internal gas springs prevent sudden collapse. The spring pressure may be arranged to decay slowly under emergency conditions, if required.
 3. In the case of sudden catastrophic loss of power and gas spring pressure, the rams act as powerful dampers, controlling the gentle return of the base to the loading position.