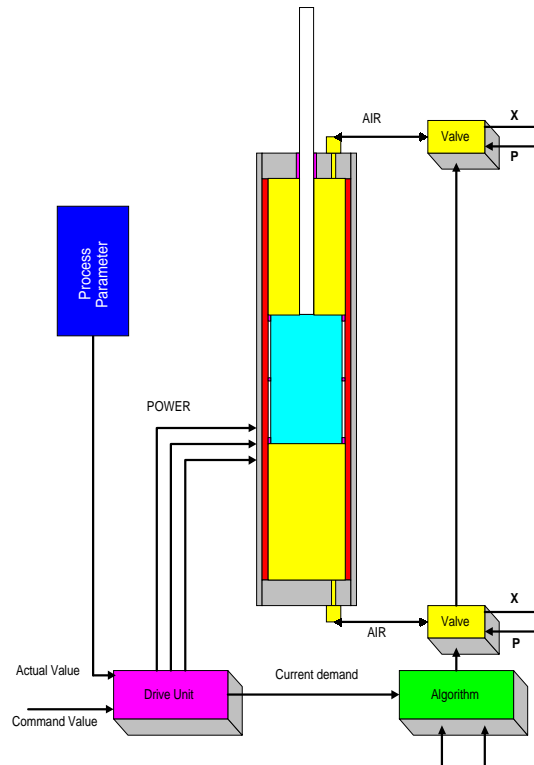


Notes on the use of electromagnetic rams in manufacturing machinery



A typical industrial ram consists of 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.

Any deadload or slowly-changing thrust required of the ram is provided by gas (air), usually at a mean pressure well below 10 bar. The gas pressure changes as the ram moves rapidly back and forth. The mean pressure on either side of the piston is automatically adjusted from time to time, according to a simple algorithm that monitors and integrates the value of the current demand, thus compensating automatically for temperature changes, leaks, load changes and temporary stops. Air is not consumed during normal operation.

When controlling the reciprocating motion of an inertial load, the gas springs store and return the energy required to accelerate the mass in forward and reverse directions, saving power and reducing heat loss

Electromagnetic rams in automation uses

- **Silent, all electronic** system
- Off-the-shelf power unit and controller
- No Hydraulics
- No mess, no cooling, no pumps or high-pressure pipes
- Simple, wide-tolerance, robust mechanical design
- Inherent self-monitoring of system characteristics
- Very low maintenance requirement

- **Extreme positioning accuracy** independent of load or velocity
- Speeds greater than 5 metres/second
- Thrusts to more than 20 tonnes
- Strokes to more than 10 metres
- High efficiency - increases with speed of movement
- Zero mechanical backlash – force is created at the point of load
- Zero electrical hysteresis
- Zero transport lag
- Milliseconds control time constant
- Inherent force sensing
- Dual pneumatic/electromagnetic action minimises power demand

- **Fail safe dynamic braking** can be arranged if required