

Closed loop pressure control

If a drive has to put pressure accurately on a workpiece or has to build predefined pressure curves it has to be controlled by a closed loop pressure control. The controller tries forcing the cylinder chambers to reach or to hold the required pressures at all events despite the piston position. If the piston is moving due to any circumstance (e. g. because of the moulding's yielding) the related velocity is conceived as the disturbance in case of a closed loop pressure control system.

A system can only build up a pressure if it senses an according counterforce. This means that a pressure can't be build up without a force working against it; if it would miss the system would accelerate permanently. Thus, a hydraulic drive in a closed loop pressure control system only makes sense, if the piston rod end perceives a counteracting force, e. g. caused by a workpiece which has to be moulded.

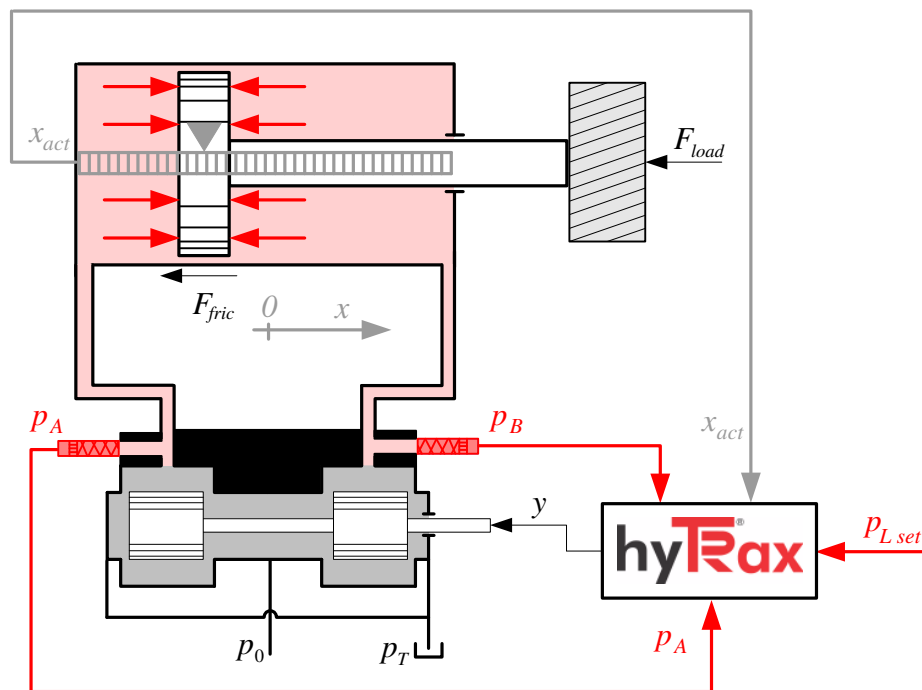


Fig.: Hydraulic cylinder drive in a closed loop pressure control system

Strictly speaking, the load pressure as the system's controller signal only is an auxiliary process signal. Essentially, the pressures inside the chambers are not of interest but the force at the piston rod end which is caused by these pressures. Thereby, forces due to acceleration can't be considered. Friction forces can be respected merely partly. If the force at the piston rod end is the matter of interest essentially, a real closed loop force control is necessary (see below).

Closed loop pressure control refers to the following: The pressures in the cylinder chambers are measured by pressure transducers. The controller calculates the so called 'load pressure' of these signals and compares it to the load pressure set signal, thus, the control error is calculated. By weighting it with the control parameters the valves control signal (e.g. voltage) is generated, until the drive has build its set load pressure.

Typically, a hydraulic drive has to build or to hold predefined pressure curves during the piston's movement as well. These set curves are specified by the drive's characteristics concerning the required load pressure and its derivative. Such movements as mentioned above often cause a significant drop in pressure. To avoid these disturbances the model based predictive controller is used in hyTRax by default for closed loop pressure control systems.