

## Closed loop force control

If a drive has to apply force accurately on a workpiece or has to build predefined force curves it has to be controlled by a closed loop force control. The controller tries forcing the cylinder chambers to reach or to hold such pressures at all events despite the piston position so that the required force is sensed at the piston rod end. 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 force control system.

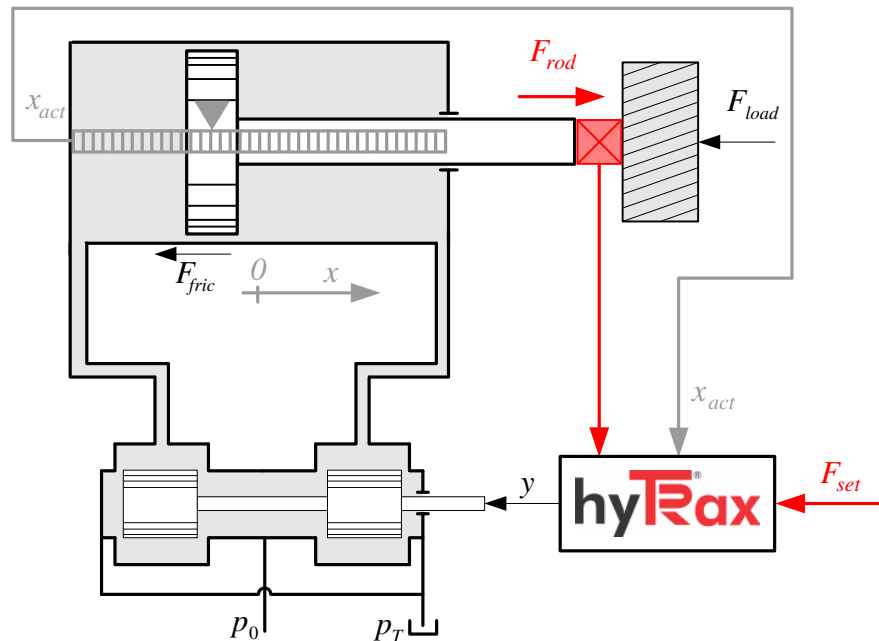


Fig.: Hydraulic cylinder drive in a closed loop force control system

The annotations herein mentioned for the closed loop pressure control are valid as well as for the closed loop force control. The difference between a closed loop load pressure control and a closed loop force control consists of the different control signals: In case of the force controller the real force at the piston rod end is the process signal to be controlled. Thereby, disturbing effects are taken into account, like acceleration or friction.

A force transducer assures much better resolutions than according pressure transducers. The outcome of this is a higher expected control accuracy. But, a force transducer is much more expensive than two pressure sensors needed for a load pressure controller. Thus, a proper cost-benefit ratio has to be taken into account concerning a force or a load pressure controller.

Closed loop force control refers to the following: The actual force at the piston rod end is measured by a force transducer. The controller compares it to the force 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 force.

Typically, a hydraulic drive has to build or to hold predefined force curves during the piston's movement as well. These set curves are specified by the drive's characteristics concerning the required force 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 force control systems.