

Low-cost sensors for cylinder applications

Gas pressure springs are often used to reinforce the muscle power of persons, providing controlled lifting and lowering of covers, hoods, flaps, etc. For example, tailgates on motor vehicles are fitted with gas pressure springs to ease raising the rear door. Hydraulic and pneumatic absorbers, which are used to retard movements in a controlled manner, are constructed similar to gas pressure springs.

These systems act completely passively and must therefore be operated by actuators or by muscle power. Of a basic similar construction are actuators, such as for example hydraulic or pneumatic cylinders which however can execute active movements. In practice mixed systems, such as hydraulic absorbers with gas pressure springs, are also found. In the following all systems (absorbers or gas pressure springs or also hydraulic and pneumatic cylinders) are designated as cylinders for the sake of simplicity. Since these systems are also associated with movement, it is often necessary to control this movement. Therefore, the movement must be monitored, normally by using displacement or position sensors. Pure position sensors are generally proximity switches which acquire the movement of a piston in the cylinder at the end positions. In contrast, for a closed-loop control, displacement sensors are used which measure the movement continuously and supply a linear signal.

Sensor data

- Measurement ranges: 20...200 mm (other measurement ranges on request)
- Accuracy: $< \pm 1\%$ FSO over complete temperature range
- Temperature range: $-40 \dots +150^\circ\text{C}$
- Resolution: 11 bit
- Bandwidth: Up to 1 kHz



Displacement sensor for hydraulic cylinder for trunk lid



Frictional damper for washing machines with integral sensor



Applikation

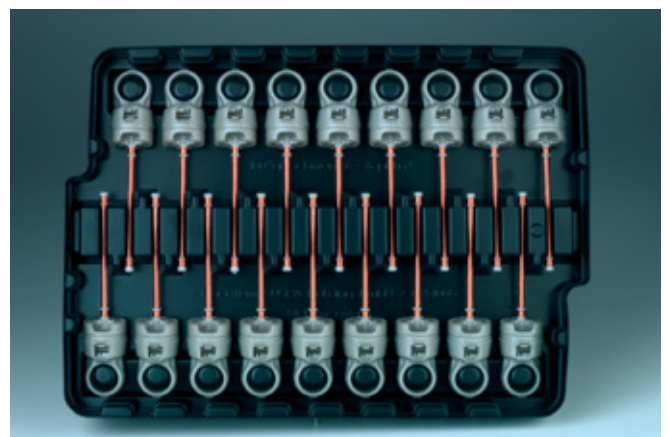
Simple sensors, for example draw-wire sensors, can be fitted outside of the cylinder. Although the installation is in this case very easy, there is a serious disadvantage in that the sensors are not protected and can be easily damaged. The best solution is therefore to mount the sensors inside the cylinder. Although they must withstand the pressure, they are safely protected from the surroundings. A further advantage is that the cylinder size does not change or only slightly changes.

There are displacement sensors for use in cylinders from Micro-Epsilon in a number of versions based on the eddy current principle. The sensor consists of a coil which is excited with an alternating voltage. This produces an electromagnetic alternating field which induces eddy currents in a target material. The eddy currents react on the coil according to Lenz's Law and are therefore attenuated. The attenuation is processed in the evaluation electronics and output as a linear signal.

Standard sensors for industrial applications use an aluminum tube or ring as the target which is mounted in the piston rod. The dead range at the start and end of the coil, which cannot be used for the measurement, is very slight and in extreme cases may be only 5 mm. As a result, in comparison to magnetostrictive sensors, a substantially shorter installation length for the sensors is possible.

For applications in gas pressure springs or hydraulic cylinders, which are employed in large quantities, for example in cars, the sensor can be simplified further. Here, for example, instead of an (additional) aluminum target, just the piston rod itself is used as the target. In this way an additional component is no longer needed, saving costs. The sensor itself is then a low-cost component, which can be inexpensively manufactured on a large-scale, for example, by plastic injection molding. With the integrated ASIC electronics and molded-on plug or cable connection, the sensor is extremely small for installation and can be ideally adapted to the cylinder so that a compact and rugged unit is produced.

Actual application examples are dampers for washing machines or hydraulic cylinders for the trunk lid actuation on cars. Anywhere where a compact construction or stable, linear measurement signals are needed, displacement sensors for integration from Micro-Epsilon are the ideal solution.



Customized displacement sensors for use in large-scale production

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