

## Active suspension cylinder

Modern mobile cranes are always employed when heavy loads must be lifted quickly and at various locations. They are used, for example, in the recovery of broken down trucks. The field of operation is not restricted to metalled roads, but also includes deployment in open terrain. Therefore, these cranes possess an adaptive design of running gear in which the suspension of each independent axle can be adapted to the relevant terrain. This is implemented using a suspension cylinder which is fitted with a displacement sensor. The sensor acquires the cylinder stroke and consequently enables the best possible adaptation to the form of the terrain. The active closed-loop control is especially important when the vehicle moves from the rough terrain back onto the road. The axles must then be adjusted to the flat road by moving all the cylinders to their normal positions. For this, the exact displacement measurement of the hydraulic cylinders is decisive. For this application Micro-Epsilon has developed a displacement sensor which is integrated into the cylinder and directly acquires the piston position. Of course, the sensors must be designed for the high peak pressures in the cylinder.

Through the installation in the cylinder, the sensor is however protected against external damage. A compact design is especially important, because the installed length of the cylinder is specified and an extension just for displacement measurement would not be accepted. The sensor itself operates according to the eddy-current loss principle in which eddy currents are induced in an aluminum tube embedded in the piston. Since no mechanical contact takes place between the sensor and the piston, the sensor is completely wear-free and therefore needs no maintenance. The integrated electronic system converts the displacement signal into an electrical signal which is used by the controller for closed-loop control. The measurement principle does not require any magnet, so the risk of collecting metal swarf is eliminated. It has been possible through successive optimization to offer high quality sensors in large quantity at low prices, so that a broad application in hydraulic cylinders has become possible.



hydraulic cylinder



mobile crane

# Application

## Measurement system requirements:

- Measuring range 220 mm and 260 mm
- Linearity typical  $\pm 0.5\%$  FSO
- Resolution 0.1 mm
- Dynamics 150 Hz (-3dB)
- Temperature range -40...+85°C
- Temperature stability  $< \pm 0.02\%/K$  FSO
- Medium hydraulic oil to 450 bar
- Protection class IP67

## Decisive advantages

- Short sensor design, but with a large measurement range.
- Pressure-proof, rugged sensor for integration.
- Non-contact measurement principle without magnet.

