

Application Note

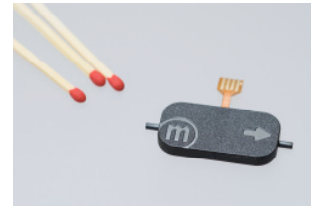
Minimal Lubrication with Micropumps

Along with the request for higher lifetime, functional safety and efficiency in mechanical systems, automated lubrication gains importance in different markets. Examples from the industrial environment are linear guidings or machine bearings. Other innovative approaches include lubrication of office machines and other portable motor driven devices.

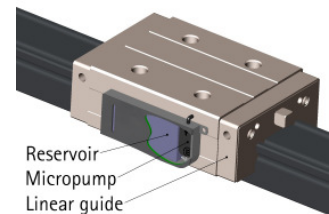
As an example, the lubrication of linear guidings is discussed here. Besides lifetime lubrication with grease, especially under high dynamic loads lubrication with oil offers better results and longer lifetime. Dependent on the requirement either continuous or interval based supply of oil is considered. While this is achieved by a centralized oil reservoir and a passive distribution system in many cases, micropumps allow the placement of the lubrication unit directly next to the bearing as shown in the example on the right side. The small dimensions and low energy consumption of the pumps together with a low production price provides an outstanding suitability for these applications. Dependent on the application, two use cases can be distinguished. Either a low continuous supply of lubricant needs to be established or the lubricant is supplied in larger single portions in a defined interval.

In the first case where a low but constant flow rate is required, the combination of the pump with a passive flow restrictor is recommended in most cases. Using oils with 100 or 150 mPas minimal flow rates of about 2 $\mu\text{l}/\text{min}$ are achievable. The maximum flowrate is estimated by scaling the maximum flow of 6000 $\mu\text{l}/\text{min}$ by the viscosity in mPas. Therefore using a 100 mPas oil, about 60 $\mu\text{l}/\text{min}$ are possible. The maximum viscosity levels that can be handled are typically in the order of 200 mPas.

The second operation mode requires the supply of single oil portions in the range of 1–1.5 cm^3 in certain intervals. As an example, typical delivery curves at varying temperatures using a 5W40 oil are shown in the following diagram. While the black graph shows the behavior of an unoptimized pump driver over



Micropump mp6

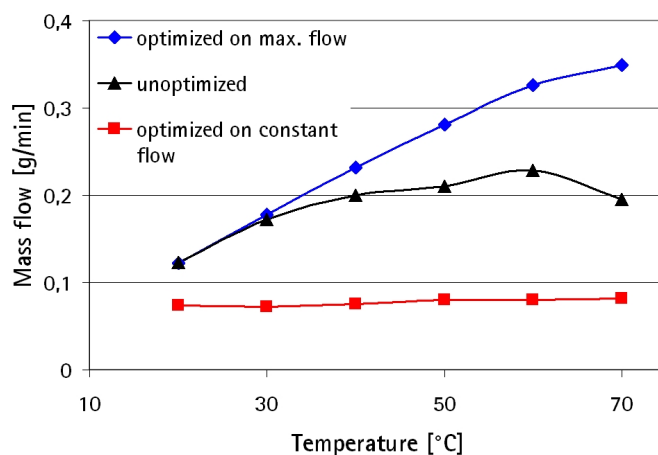


Linear guiding system combined with lubrication unit



temperature, optimization can be achieved towards the requirements of different applications.

Often the target is a constant pulse volume over temperature, as is shown in the red graph. To achieve this performance with a flow rate below 0.1 g/min, the pump is operated about 15 minutes per interval. To keep the pumping cycles as short as possible or to take the higher consumption of oil at elevated temperatures into account, the pump can also be optimized to achieve maximum flow at each temperature which is shown by the blue graph. Based on requirements and lubricant customized flow profiles can be established.



While the pump has dimensions of only 15 x 30 x 3.8 mm³, the overall size of the unit is strongly dependent on the volume of the oil reservoir. Due to the low power consumption of only 100 – 150 mW, both battery driven autarkic units and drivers based on 24 V can be applied. For both desktop and miniaturized systems, evaluation electronics are available that can be customized towards the final application.

Besides standard components, Bartels microComponents is specialized in the development of application specific pumps and system integration.

