

TheOnyx

Micro-Annular Gear Pumps Drive TheOnyx

Introduction

One of the challenges any automated liquid handling robot faces is the ability to pipette with accuracy and precision across the entire dynamic range of liquid volumes. This capability is especially important in many applications such as plasmid miniprep and downstream sequencing, or microarray sample preparation, where often the requirement is to pipette both low and high volumes during a single process. In addition, the liquid handling technology ideally will be robust and reliable in order to minimize system downtime and maintenance. TheOnyx addresses these requirements by incorporating third generation fluidics, replacing altogether the traditional syringe pump mechanism.

- Wide dynamic range with no pump or syringe changes
- Accuracy & precision at low volumes
- Rapid dispensing at high volumes
- Avoids inherent compromise of syringe pump based systems
- longer lifetime, less maintenance, lower cost of maintenance
- Wider range of liquids can be safely used (DMSO, methanol, etc.)

What are micro-annular gear pumps & how do they work?

Micro-annular gear pumps (**Figure 1**) are rotary pumps incorporating toothed rotors bearing slightly eccentric to each other. Both rotors are interlocked at any one time, and while rotating form a system of sealed pumping chambers. During rotation (under software control), the pumping chambers simultaneously increase on the induction side and decrease on the delivery side (**Figure 2**). A homogeneous flow rate is generated between the inlet and outlet, and liquid is thereby driven through the system tubing to the dispensing tips.



Figure 1: Micro-annular gear pump; diameter 13 mm, length 75 mm

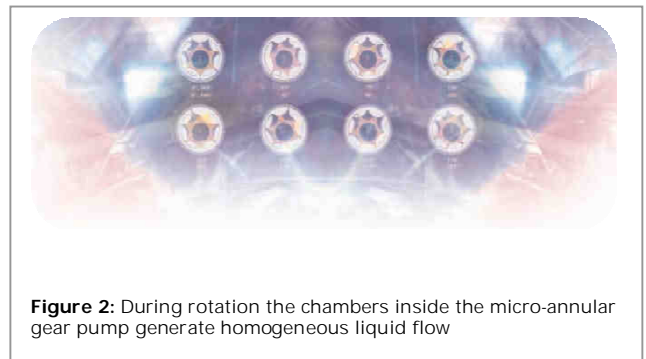


Figure 2: During rotation the chambers inside the micro-annular gear pump generate homogeneous liquid flow



What are the advantages?

For end-users this translates into a wider dynamic range with no hardware changes or compromises in accuracy or precision. This overcomes a limitation of older syringe pump based systems, where dynamic range is restricted by the volume of the syringes – low syringes achieve good accuracy and precision but they are not suitable for pipetting higher volumes, while higher volume syringes cannot achieve the required accuracy and precision at low volumes that many applications demand. Micro-annular gear pumps offer an additional advantage in being resistant to a wider range of liquids such as DMSO and methanol.

How reliable are they?

The MZR 2921 micro-annular gear pumps used in a standard configuration TheOnyx were subjected to lifetime tests of 400 hours continuous aspiration and dispensing of 1,000 µl of liquid. Performing 30 moves per minute, this corresponds to 720,000 pump movements. Throughout this period, no pump movements were observed and pipetting performance was not affected. Based on an assumed typical instrument usage of 500 movements per day, this corresponds to a pump lifetime in excess of 5 years (compared with syringe pumps which typically are replaced at least once per annum).

Technical Information

Flow rate:	0.3 – 18 ml/min
Resolution:	0.1 µl increments
Displacement volume:	3 µl
Operating pressure range:	0 – 3 bar (0 – 44 psi)
Operating temperature range:	-20 to +60°C
Viscosity range:	0.5 to 50 mPas
Speed range:	100 – 6,000 rpm
Fluidic connections:	Slip fittings with outside diameter 2 mm
Casing material:	Nickel-silver, epoxy resin
Rotors, shaft, bearings:	Tungsten carbide, Ni-based
Shaft seal:	graphite reinforced Teflon®, spring 316 L
Static seals:	Viton®
Motor:	DC-motor with graphite brushes
Measurements:	Diameter 13 mm, length 75 mm
Weight:	56 g approx.

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