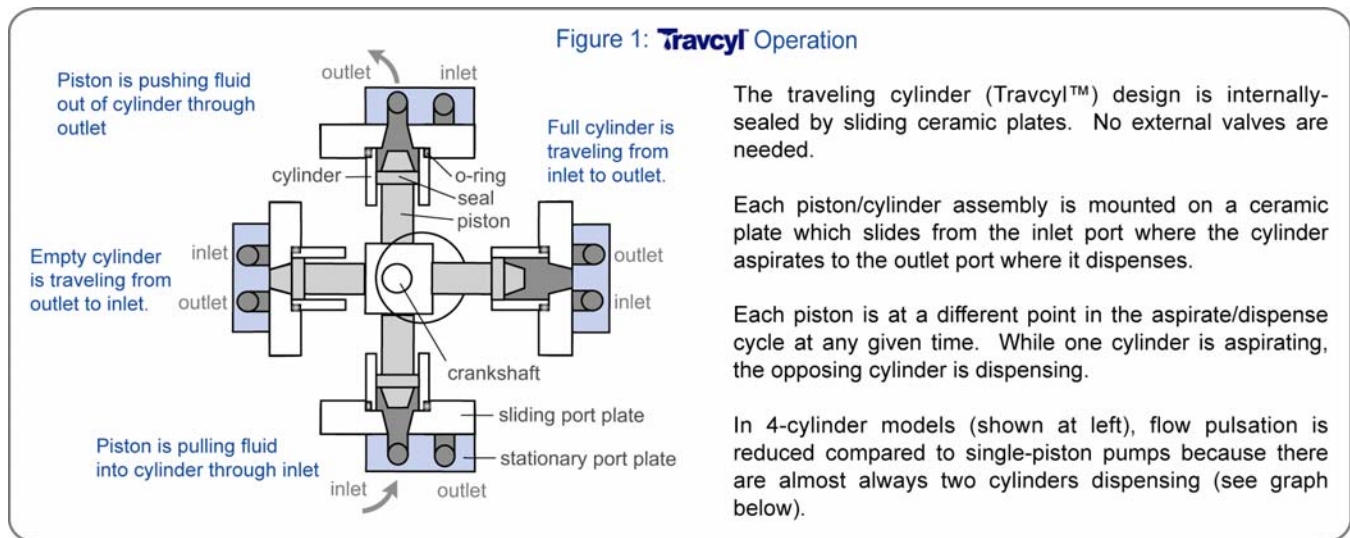




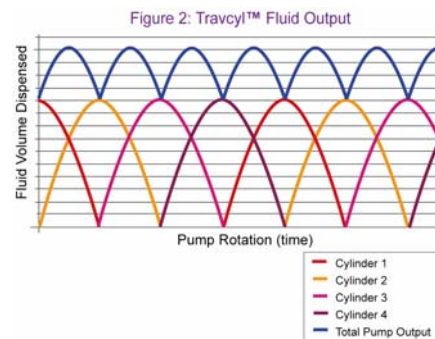
Car-May - Travcyl™ Technology

The Travcyl™ (traveling cylinder) design is an internally-sealed, valveless pump technology which provides absolute control over fluid movement. The Travcyl™ design integrates the durability of a piston pump and the accuracy of a syringe pump. Travcyl™ Systems have one, two, or four fluid chambers (cylinders), each with its own piston and high performance seal. All of the System's cylinder/piston assemblies are driven by a single offset crankshaft. As the pistons move fluid in and out of the cylinders, the cylinders slide (travel) from inlet port to outlet port. Operating as a rotary syringe device, the Travcyl™ System continually and automatically aspirates (fills) and dispenses (empties) each cylinder in succession.



Travcyl™ Fluid Output

Figure 2 illustrates the volumetric fluid output of a four-cylinder Travcyl™ System. The total output (blue line on top) is the sum of the outputs from the four individual cylinders over time during constant pump rotation. As shown by the peaks in the total output plot, native Travcyl™ operation produces some flow pulsation. Travcyl™ pulsation is 20% or less of total flow. Other types of pumps including peristaltic pumps produce much higher levels of pulsation, and conventional single-piston pumps produce 100% pulsation. Four-piston Travcyl™ Systems are available with the software algorithm NovaFlow (see Nova Technology, next page) which further reduces Travcyl™ flow pulsation.



Digitally-controlled, Internally-sealed

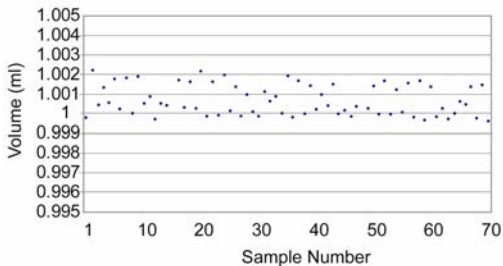
Travcyl™ Systems control metering flow rate through the speed (rpm) of the motor, and they measure dispense volume through crankshaft rotation. Digital control of fluid delivery ensures the repeatability and precision that automated processes and development applications demand. User calibration is not required because flow rate and dispense volume are not adjusted by physical re-orientation of parts (as is the case with many other pump technologies).

The ceramic port plates internally seal the Travcyl™ System. Valves are not needed because when the motor stops, fluid flow stops – positive displacement! There is never an open flow path between the fluid inlet and outlet. This eliminates potential inlet/outlet fluid contamination and also increases accuracy.



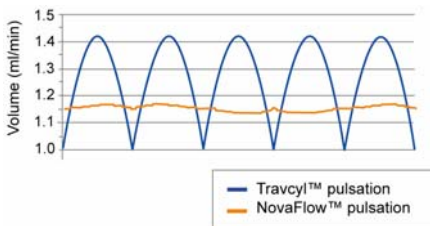
Nova Technology

Nova Technology provides even better performance and control for fluid management than Basic Travcyl™ Systems do. The Nova product line includes enhanced four-piston Travcyl™ System Modules (2-4 and 16-4) and any products incorporating these enhanced Systems. Two software algorithms, NovaSpense™ and NovaFlow, are programmed into the Nova System's intelligent servo motor and are used to precisely control fluid delivery. NovaSpense™ dramatically increases accuracy and control for dispensing, and NovaFlow significantly reduces pulsation during metering. Nova capabilities are standard features in the Base Station and are optional in System Modules 2-4 and 16-4.



NovaSpense™

NovaSpense™ is the software algorithm that controls the enhanced Travcyl™ System for exceptionally accurate dispensing. Test results for NovaSpense™ dispensing are shown at left. The target dispense volume represented is 1.000 ml. The repeatability and accuracy that NovaSpense™ provides are ideal for automated manufacturing and precision laboratory applications.



NovaFlow

The metering accuracy of Basic Travcyl™ Systems is exceptional. However, when low-pulsation is also required, NovaFlow is the software algorithm that reduces instantaneous pulsation to as little as 3% of total flow during metering. NovaFlow can be utilized for flow rates between 100 nl/min and 20 ml/min with a Model 2-4 Nova System, or 1 ul/min and 200ml/min with a 16-4 Nova System. Shown at left: 1.15 ml/min Basic Travcyl™ vs. NovaFlow Pulsation.

Materials

The wetted parts of "Standard configuration" Travcyl™ System Modules are made from chemically-resistant materials, creating a versatile, durable fluid control system. For applications that require the use of more aggressive fluids, an even more robust "Inert" wetted parts option is available. Please call us for compatibility information for specific aggressive chemicals.

Wetted Parts Materials

		Standard	Inert
Housing	2-series	Delrin™	PEEK
	16-series	Ertalyte™	Ertalyte™
Manifold		PEEK, Tefzel™,	PEEK, Tefzel™,
		316L stainless steel	316L stainless steel
Manifold O-rings		Viton™	Perfluoroelastomer
Port Plates		Ceramic Al ₂ O ₃	Ceramic Al ₂ O ₃
Piston Seal		Teflon™ or UHMW	Teflon™ or UHMW
Cylinder/ fluid chamber		Pyrex™ glass	Pyrex™ glass

