Syringe Pumps for Microfluidics

Pump 11 Elite • PHD ULTRA™ • Pump 33 DDS • Nanomite

Harvard Apparatus

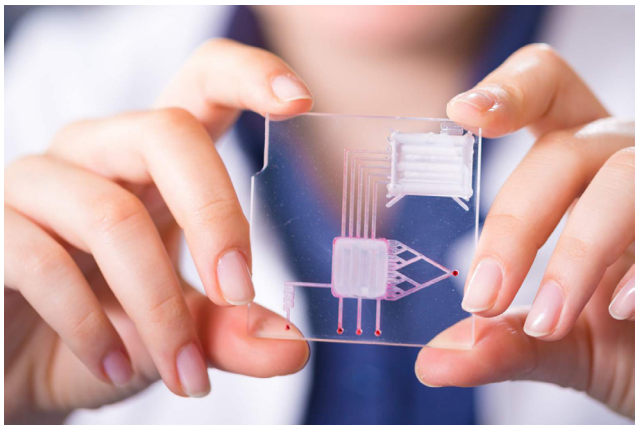
a division of **Harvard Bioscience, Inc.**

Microfluidics — Directing the Flow of the Future

Microfluidics is an interdisciplinary convergence of biotechnology, chemistry, physics and engineering that is revolutionizing research capabilities for a vast array of applications.

It is the science of precisely controlling and manipulating the behavior of minute flows of liquids, in the range of microliters to picoliters—in sub-millimeter channels and other structures—to perform a variety of experiments and functions.

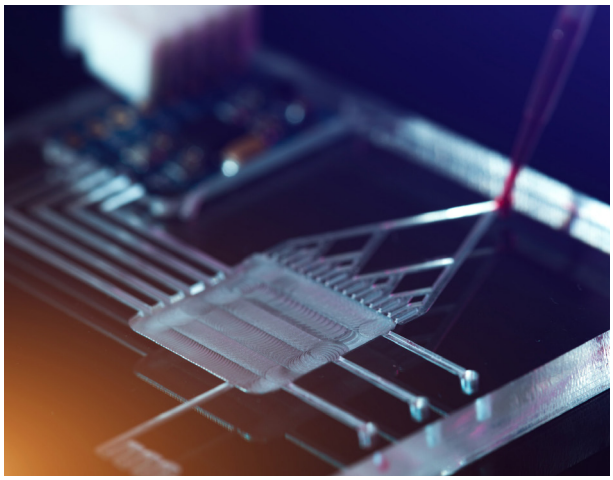
In fact, microfluidics is front and center—directing the future of fluidics research.



Harvard Apparatus Pumps in the Field

Helping to Satisfy Vast and Diverse Microfluidics Applications

Harvard Apparatus offers a variety of proven syringe pumps that provide the exacting performance and flow stability requisite to success in microfluidics research. Our syringe pumps are cited in thousands of research publications satisfying vast and diverse applications.



- Lab-on-a-Chip
- Organ-on-a-Chip
- DNA analysis
- PCR amplification
- Ultra-high throughput biological assays
- Cell sorting
- Point-of-Care diagnostics
- Proteomics
- Biosensors/BioMEMS
- Microreactors
- Droplet formation

Choose from single and multi-channel volume and pressure-controlled pumps with flow rates from picoliters to milliliters. We can provide standard models, specials and OEM modules designed to meet your microfluidic application needs. In addition to pumps we carry syringes, connectors and tubing. Please contact our Technical Support team to help choose the correct syringe pump and accessories for your application.

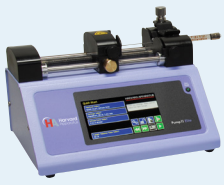
With more than 100 years of success behind us and a proven track record of designing and manufacturing high quality reliable syringe and peristaltic pumps, only Harvard Apparatus has the scientific depth and fluidics knowledge to recommend the right pump and accessories for your application. Our superior technical experts are available to assist you from start to finish. Harvard Apparatus invented the lead screw based syringe pump in the 1950's and introduced the first microprocessor pump, the now legendary Pump 22, in the 1980's. Our syringe pumps are so accurate, that even at low flow rates they have become the standard for mass spectrometry calibration, physiological research and anywhere accurate volumes must be delivered.

Harvard Apparatus Microfluidics Syringe Pumps

Quality Flow, High Accuracy & Precision, Flexible & Feature Rich

With thousands of high-quality syringe pumps in use, you can count on Harvard Apparatus syringe pumps to provide smooth, accurate repeatable flow for your microfluidic experiments. Harvard apparatus syringe pumps are designed with the linear force to provide flow into the smallest of channels without stalling.

- Choose from Infusion Only, Infusion/Withdrawal, Programmable, Standard and Remote models.
- Adjustable linear force up to 200 lb (90.7 kg), model dependent.
- Reduce error risk with smooth, precise flow control—down to the pl/min.
- Set up and store multiple, multi-step programs with a smart, color touchscreen display.
- CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme compliant.

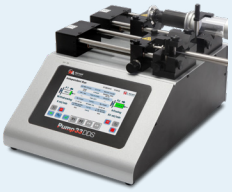


Pump 11 Elite

Accuracy*: ±0.35 – 0.5%
Syringe Size:
*Single 0.5 µl – 60 ml
*Dual 0.5 µl – 10 ml
Flow Rates:
Single Syringe*
0.54 pl/min – 88.4 ml/min
Dual Syringe*
0.54 pl/min – 26.02 ml/min
(*model dependent)

PHD ULTRA™

Accuracy: ±0.25%
Syringe Size:
0.5 µl – 140 ml
Flow Rates:
1.5 pl/min – 216 ml/min



Pump 33 DDS

Dual Independent Syringe Pump
Accuracy: +/- 0.25%
Syringe Size: 0.5 µl – 60 ml
Flow Rates:
1.02 pl/min – 106 ml/min

Nanomite

Stereotaxic compatible
Accuracy: ±0.5%
Syringe Size: 0.5 µl – 1 ml
Flow Rates:
3.66 pl/min – 3.82 ml/min

Microfluidic Syringe Pumps from Harvard Apparatus	Catalog #
Pump 11 Elite Single Syringe Infuse Only	70-4500
Pump 11 Elite Dual Syringe Infuse Only	70-4501
Pump 11 Elite Single Infuse/Withdraw/Programmable	70-4504
Pump 11 Elite Dual Infuse/Withdraw/Programmable	70-4505
Pump 11 Pico Plus Elite Single Infuse/Withdraw/Programmable	70-4511
Pump 11 Pico Plus Elite Dual Infuse/Withdraw/Programmable	70-4506
Pump 11 Elite Nanomite Infuse/Withdraw/Programmable	70-4507
PHD ULTRA™ Dual Infuse Only*	70-3005
PHD ULTRA™ Dual Infuse/Withdraw/Programmable*	70-3007
PHD ULTRA™ 4400 Infuse/Withdraw/Programmable*	70-3010
PHD ULTRA™ Constant Pressure Dual (I/W/P)	88-3015
PHD ULTRA™ Constant Pressure 4400 (I/W/P)	88-3016

**Available in remote configuration. The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30-ft RS-485 (IEEE-1394) cable.*

Selected References

The Pump 11 Elite infusion syringe pump helps to develop microfluidic technology to screen for various pathogens at the point-of-care and clinical settings.

Asghar W, Sher M, Khan NS, et al. Microfluidic Chip for Detection of Fungal Infections. *ACS Omega.* 2019 Apr 30;4(4):7474-7481. doi: 10.1021/acsomega.9b00499. Epub 2019 Apr 24.

The Pump 33 DDS (Dual Drive System) syringe pump was successfully used to research microreactors for the synthesis of silver nanoparticles.

Hao N, Nie Y, Xu Z, Zhe X, Zhang JXJ., Ultrafast microfluidic synthesis of hierarchical triangular silver core-silica shell nanoplatelet toward enhanced cellular internalization. *J Colloid Interf Sci.* 2019 Apr 15;542:370-378. doi.org/10.1016/j.jcis.2019.02.021.

Researchers used the PHD ULTRA™ to develop a microfluidic model to mimic the in vivo human airway.

Liu Z, Mackay S, Gordon DM, et al. Co-cultured microfluidic model of the airway optimized for microscopy and micro-optical coherence tomography imaging. *Biomed Opt Express.* 2019 Sep 30;10(10):5414-5430. doi: 10.1364/BOE.10.005414. eCollection 2019 Oct 1.

The Nanomite was a key component in the characterization of a microfluidic chip blood brain barrier model.

Terrell-Hall, T.B., Ammer, A.G., Griffith, J.I.G. et al. Permeability across a novel microfluidic blood-tumor barrier model. *Fluids Barriers CNS.* 2017;14:3. doi.org/10.1186/s12987-017-0050-9.

The PHD ULTRA™ was used to develop microfluidic bone marrow models to study leukemia treatments.

Bruce A, Evans R, Mezan R, et al. Three-Dimensional Microfluidic Tri-Culture Model of the Bone Marrow Microenvironment for Study of Acute Lymphoblastic Leukemia. *PLoS One.* 2015 Oct 21;10(10):e0140506. doi: 10.1371/journal.pone.0140506. eCollection 2015.

The Pump 11 Elite was used to develop a low-cost protein detection assay to rival the more expensive ELISA method.

Mok J, Mindrinos MN, Davis RW, Javanmard M. Digital microfluidic assay for protein detection. *Proc Natl Acad Sci U S A.* 2014 Feb 11;111(6):2110-5. doi: 10.1073/pnas.1323998111. Epub 2014 Jan 21.

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