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PHD2000 Syringe Pumps

HARVARD
APPARATUS

Nothing compares to a syringe pump when it comes to high accuracy and ultra-low flow rates. As part of a seven-year-old corporate partnership, Instech Solomon is proud to offer the complete line of pumps from Harvard Apparatus, the leading manufacturer of syringe pumps for life science research. With one phone call, customers can draw on Instech and Harvard's decades of combined expertise with a broad range of pump mechanisms.

In this catalog we have highlighted Harvard's most advanced series of microprocessor-controlled syringe pumps. However, we will choose from all of their pumps and all of our own to satisfy your unique requirements—whether you need a low-cost microdialysis pump, a pump that generates up to 250 pounds of linear force, a pump that runs off a solar cell or a pump that simulates a beating heart.

Please note that all of these pumps have been designed for research and industrial applications only. They are not approved for clinical use.



PHD2000 Series Pumps

The PHD2000 pump series combines Harvard's best pump mechanism, a redesigned user interface and a wide range of configuration options. All PHD2000 models can deliver the ultra-low smooth flow rates required for microdialysis.

A lookup table in the pump's software contains the dimensions of syringes from all the major manufacturers. A bright, two line display lets you read all the pertinent information from across the lab. All models have RS-232 and TTL ports for external control and monitoring. Up to 99 pumps can be joined together with daisy-chain cables and operated from a single computer. Windows®-based Symphony™ software (sold separately) lets you control and monitor one or more syringe pumps from your PC.

To choose a pump configuration: (1) determine how much programmability you need, (2) determine which syringe rack best suits your application, and (3) determine whether you require any special configurations, such as high-pressure, remote control, or continuous flow. Both programmability and syringe racks can be upgraded later, if needed.

Programmability

Infuse Only. Ideal for applications such as microdialysis that require high accuracy and low flow rates without the need for fluid withdrawal or complex protocols.

Infuse/Withdraw. The lead screw on these pumps can reverse direction to withdraw fluid and refill the syringe.

Programmable. Use programmable pumps to administer complex protocols. For example: deliver a bolus then ramp down to a steady infusion rate; deliver doses of a drug several times a day for several weeks on end; deliver a small dose of a potent drug, then send a TTL signal to a separate pump to flush saline through the line. Non-volatile memory stores up to four programs of nine sequences.

Symphony is a trademark of Harvard Bioscience
Windows is a registered trademark of Microsoft

PHD2000 Syringe Pumps

Syringe Racks

All PHD2000 pumps include the basic dual-syringe rack. If ordered with the pump, the multi-syringe racks come pre-installed; if ordered later they can be installed in minutes with the turn of a few thumb screws.



Basic dual syringe rack. Holds one or two syringes of the same size, from 0.5µl to 140ml. To hold large syringes, the syringe bracket flips over.



6 to 10 MultiRack. Holds ten syringes from 10ml up to 30ml in size, or six syringes up to 60ml in size.



4 x 140 MultiRack. Holds up to four syringes between 30ml and 140ml in size.

Microdialysis Rack. Holds four 0.5µl to 10ml syringes for microdialysis with up to four probes or other low-flow applications. Independently adjustable thumb screws let you infuse with different sized syringes simultaneously.

Flow Rates and Max Pressures For Widely Used Syringes

| SYRINGE SIZE | MIN FLOW | MAX FLOW | MAX PRESSURE ¹ |
|--------------|---------------|---------------|---------------------------|
| 0.5 µl | 0.0001 µl/hr | 0.0953 ml/hr | ~ ² |
| 1 µl | 0.0002 µl/hr | 0.1907 ml/hr | ~ ² |
| 2 µl | 0.0004 µl/hr | 0.3813 ml/hr | ~ ² |
| 5 µl | 0.0010 µl/hr | 0.9532 ml/hr | ~ ² |
| 10 µl | 0.0019 µl/hr | 1.9013 ml/hr | ~ ² |
| 25 µl | 0.0046 µl/hr | 4.7752 ml/hr | ~ ² |
| 50 µl | 0.0092 µl/hr | 9.5511 ml/hr | ~ ² |
| 100 µl | 0.0183 µl/hr | 19.153 ml/hr | ~ ² |
| 250 µl | 0.0454 µl/hr | 47.532 ml/hr | ~ ² |
| 500 µl | 0.0911 µl/hr | 95.492 ml/hr | ~ ² |
| 1000 µl | 0.0031 µl/min | 190.95 ml/hr | ~ ² |
| 1 ml | 0.0033 µl/min | 205.30 ml/hr | 1000 PSI ² |
| 2 ml | 0.0119 µl/min | 747.35 ml/hr | 400 PSI ² |
| 2.5 ml | 0.0076 µl/min | 476.21 ml/hr | 400 PSI ² |
| 3 ml | 0.0108 µl/min | 11.231 ml/min | 300 PSI ² |
| 5 ml | 0.0208 µl/min | 21.781 ml/min | 200 PSI ² |
| 10 ml | 0.0301 µl/min | 31.486 ml/min | 105 PSI |
| 20 ml | 0.0523 µl/min | 54.804 ml/min | 60 PSI |
| 30 ml | 0.0673 µl/min | 70.518 ml/min | 45 PSI |
| 50 ml | 0.1019 µl/min | 106.76 ml/min | 30 PSI |
| 100 ml | 0.1740 µl/min | 182.40 ml/min | 20 PSI |
| 140 ml | 0.2106 µl/min | 220.82 ml/min | 15 PSI |

¹ If using more than one syringe, divide by number of syringes. If pump is upgraded to high-pressure mechanism, multiply by 3.4. For "Big Bertha" pump, multiply by 8.6.

² Maximum pressure generated by pump is too high for glass or plastic syringes. Use stainless steel syringes when pressures may exceed 100 PSI.

Specifications

| | |
|--------------------|---------------------------------------|
| Flow control range | 1:1,000,000 |
| Max/min flow rates | Varies with syringe size (see chart) |
| Accuracy | ±1% |
| Reproducibility | ±0.1% |
| Calibration | Automatic |
| Drive motor | 1.8° stepper |
| Motor control | Microprocessor |
| Display | 2 line 40 character fluorescent |
| Memory | Non-volatile (stores all settings) |
| RS-232 interface | Multiplexed dual bi-directional ports |
| RS-232 connectors | RJ11-4 cond telephone |
| TTL connectors | 9 pin D sub |

| | |
|-------------------------------------|---|
| Linear force | 29 lbs (13 kg) With high-pressure upgrade: 100 lbs (45 kg) "Big Bertha" model: 250 lbs (113 kg) |
| Minimum step rate | 1 step/27.3 sec |
| Maximum step rate | 2400 steps/sec |
| Minimum pusher travel rate | 0.18 microns/min |
| Maximum pusher travel rate | 191 mm/min |
| Pusher advance per step | 0.082 microns, minimum Varies based on syringe and rate settings |
| Power | 115/230 VAC, 50/60 Hz User can change without opening pump |
| Weight (standard models) | 10 lb (4.5 kg) |
| Dimensions (HxWxD, standard models) | 6.3x9x11" (16x23x28cm) |

PHD2000 Syringe Pumps

HARVARD
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Special Configurations

Push-Pull / Continuous Flow. Holds four syringes from 0.5ml to 60ml, two in each direction. Set up as a push/pull pump, it can infuse and withdraw the same amount simultaneously. Use it when you don't want an infused or sampled volume to alter blood pressure. When the programmable model is combined with Instech's special valving system, shown below, it becomes a continuous flow syringe pump. Finally, no limits on the delivered volume from a syringe pump!

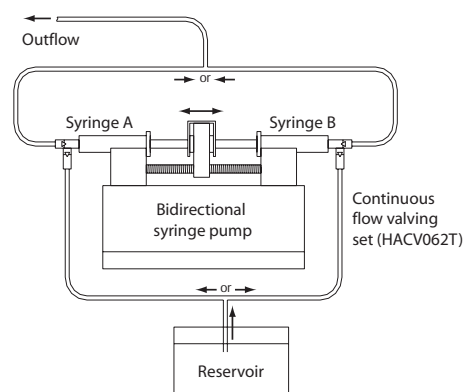
High Pressure. The motor in any of the PHD2000 models described above (except the Push-Pull/Continuous version) can be upgraded from 29 to 100 lbs linear force. This is useful when pumping viscous solutions or driving multiple syringes. Consult the pressure chart on page 39 to ensure the high pressures are compatible with your syringes.

Remote Control. When working with hazardous materials use the remote control configuration to put up to 30 feet between the pump mechanism and the control box. Available with most configurations.

Ultra-High Pressure High Capacity. Also known as "Big Bertha," this pump can handle four 50 to 200ml syringes and deliver a whopping 250 lbs (113 kg) linear force. Remote control with a 5 foot cable is standard. Order stainless steel syringes separately.



HA2000P/C



Continuous Flow Syringe Pump. Syringe A empties while B fills, then the process reverses, providing continuous outflow except for a slight pause at the transition.

Part Numbers

| SYRINGE RACK | INFUSION ONLY | | INFUSE/WITHDRAW | | PROGRAMMABLE | |
|--------------------------------|---------------|---------------|-----------------|---------------|--------------|---------------|
| | STD PRESSURE | HIGH PRESSURE | STD PRESSURE | HIGH PRESSURE | STD PRESSURE | HIGH PRESSURE |
| Standard Configurations | | | | | | |
| Basic Dual | HA2000I | HA2000IX | HA2000W | HA2000WX | HA2000P | HA2000PX |
| 6 to 10 | HA2000I/10 | HA2000IX/10 | HA2000W/10 | HA2000WX/10 | HA2000P/10 | HA2000PX/10 |
| 4 x 140 | HA2000I/4 | HA2000IX/4 | HA2000W/4 | HA2000WX/4 | HA2000P/4 | HA2000PX/4 |
| Microdialysis | HA2000I/M | HA2000IX/M | HA2000W/M | HA2000WX/M | HA2000P/M | HA2000PX/M |
| Remote Configurations | | | | | | |
| Basic Dual | HA2000IR | HA2000IRX | HA2000WR | HA2000WRX | HA2000PR | HA2000PRX |
| 6 to 10 | HA2000IR/10 | HA2000IRX/10 | HA2000WR/10 | HA2000WRX/10 | HA2000PR/10 | HA2000PRX/10 |
| 4 x 140 | HA2000IR/4 | HA2000IRX/4 | HA2000WR/4 | HA2000WRX/4 | HA2000PR/4 | HA2000PRX/4 |
| Microdialysis | HA2000IR/M | HA2000IRX/M | HA2000WR/M | HA2000WRX/M | HA2000PR/M | HA2000PRX/M |
| Special Configurations | | | | | | |
| Push-Pull | | | HA2000W/P | | HA2000P/P | |
| Continuous | | | | | HA2000P/C | |
| "Big Bertha" | | | | | | HA2000PRXB |

See <http://www.instechlabs.com/Pumps/syringe/phd2000.php> for U.S. pricing.

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