

Precision Syringe Pumps

Harvard PHD 22/2000 Advanced Syringe Pumps

- High accuracy and precision
- Low flow rate
- Ultimate flexibility and versatility
- 2 year warranty

Forty years ago Harvard Apparatus perfected the lead screw principle and created the first syringe pump. Since that time, tens of thousands of Harvard pumps have earned a reputation as the most reliable research partners in every major laboratory in the World. The PHD 22/2000 syringe pump series gives you the lowest flow rates ever, the highest accuracy, the smoothest flow, advanced programmability from the keypad and yet, is very easy to use.

Highest Accuracy and Precision

A welded steel chassis, machined Delrin™ components, upgraded guide rods, and advanced electronics give accuracy within 0.35% and reproducibility within 0.05%.

Lowest Flow Rates

A new micro stepping motor and control software give the lowest flow rates ever, down to 0.0001 µl/hour. It is also incredibly quiet so it won't disturb your experimental subjects.

Versatility

There is a PHD 22/2000 syringe pump to meet every need, whether it be simple infusion, infusion and withdrawal, or programming capabilities.

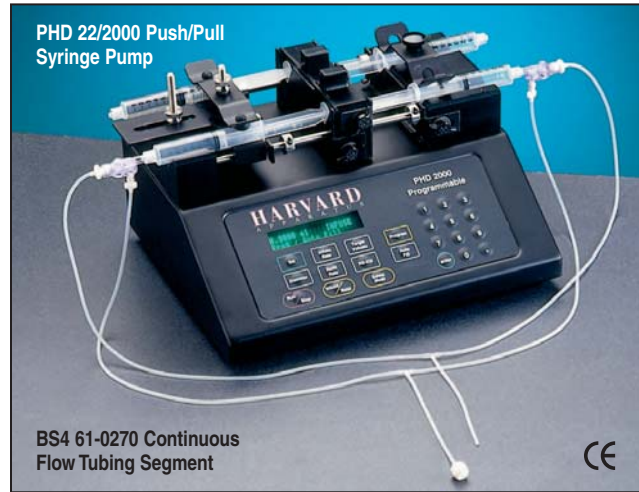
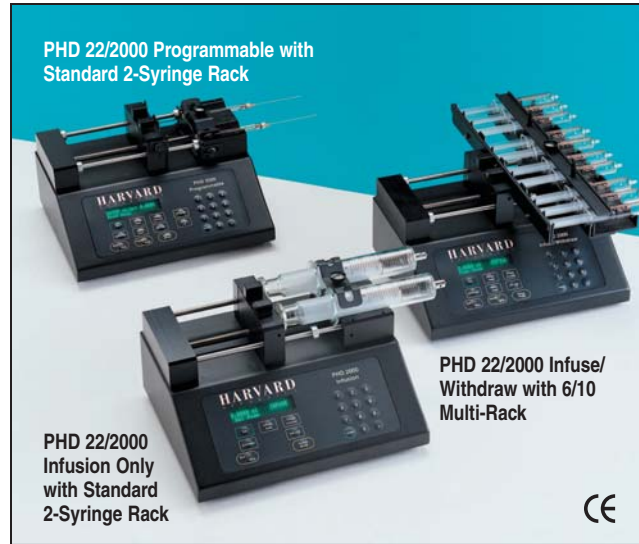
- 1. Infuse Only:** This pump is suitable for applications that require high accuracy and low rates but, do not need to withdraw fluid and do not need programmability. Should you need withdrawal or program capabilities later on, the infusion only pump can be upgraded
- 2. Infuse/Withdraw:** The Harvard PHD 22/2000 infuse/withdraw has identical performance to the infusion only model (above) but can also withdraw (refill).
- 3. Programmable:** The Harvard PHD 22/2000 Programmable pump has the most advanced programming functions and yet is very easy to use. The pump can store up to four programs of 10 sequences each. Programs are stored in non-volatile memory. No other pump can give you this level of control and flexibility. The programmable pumps may also be programmed using Symphony, Harvard's Windows™ pump manager software, see page A17.

Easy to Use

A bright, easy to read, two-line fluorescent display can be easily read from across the lab. A target volume key makes it easy to dispense a set volume. An ergonomic 'Autolock' release mechanism is easy for even small hands to operate and can never be left unlocked. The numerical keys utilize the familiar 'telephone' layout.

Upgrade

We offer pumps that can be upgraded. If you buy an infuse/withdraw pump and later decide you want programmability you can upgrade it. You pay a lot less than buying a whole new pump.



Program Description

The programming functions of this pump provide powerful capabilities for advanced experiments. While in program mode this pump can perform the following tasks at a predetermined time or when prompted by a signal from an external device:

- Start or stop pumping
- Change pumping direction (infuse-withdraw)
- Change flow rates
- Pump a precise volume and stop
- Pause operation
- Ramp up or down flow rates

In program mode the above tasks can be linked together into powerful programs to simplify your automation projects.

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Harvard PHD 22/2000 Advanced Syringe Pumps (Continued)



Introducing the three newest members to join the PHD 22/2000 family:

High Pressure Syringe Pumps

Every version of the PHD 22/2000 Pump is now available with a stronger motor that can provide more force. These pumps are ideal when working with viscous fluid or when driving multiple syringes. The standard force PHD 22/2000 series syringe pump delivers an average nominal force of 50 lbs. while the high power version delivers 66 lbs. If you require even greater force see the PHD 22/2000 Hpsi or the Pump 4400 Hpsi. Visit our website.

Remotely Controlled Syringe Pump

Use the Hpsi remote pump in hazardous environments where the researcher is safer when distanced from the material being pumped. This pump has a 30 foot cable that allows the pumping mechanism to be located remotely from the control box. Every version of the PHD syringe pump is available in a remote model (pictured above).

Push/Pull Syringe Pump

The third new member to the PHD 22/2000 family is the Push/Pull PHD 22/2000. This pump can simultaneously infuse and withdraw the exact amount. Use this when you do not want the volume infused to alter pressure. With the addition of a BS4 61-0270 Tubing Segment or a valve box, it can also provide continuous infusion. It is available in both infuse/withdraw and programmable models. The right side syringe holder is the standard 2-syringe rack found on all PHD 22/2000 syringe pumps. This standard holder will accept all the PHD 22/2000 multi-syringe racks (right side only).

For Accessories, see page A19.

For Stainless Steel Syringe, see page A70.

For GASTIGHT® Syringes, see pages A73 and A74.

For Plastic Syringes, see pages A76 and A77.

For Luer Tubing Sets and Connectors, see pages A88 to A91.

Specifications

Type	Microprocessor driven syringe pump
Accuracy	±0.35%
Reproducibility	±0.05%
Syringes Size:	
Minimum	0.5 µl
Maximum	140 ml
Flow Rate:	
Minimum	0.0001 µl/hr
Maximum	220.82 ml/min
Non Volatile Memory	Stores all settings
RS-232	RJ11-4 conductor
TTL	9 pin D-Sub. Connector
Average Linear Force:	
Standard	50 lbs
High Pressure	66 lbs
Drive Motor	1.8° stepper motor
Motor Drive Control	Microprocessor controlled from 1/2 to 1/32 microstepping
Motor Steps per one revolution of lead screw	From 800 to 12,800
Step Resolution	0.082 µm/step
Step Rate:	
Minimum	27.3 sec/step
Maximum	416.7 µsec/step
Step Resolution	0.082 µm/step
Pusher Travel Rate:	
Minimum	0.18 µm/min
Maximum	190.676 mm/min
Power	65 W, 0.5 A fuse
Voltage Range	95 to 130 VAC, 60 Hz; 220 to 260 VAC, 50 Hz, selectable
Cable Length	9.1 m (30 ft) for remote models only
Dimensions, H x W x D	15.9 x 22.8 x 27.9 cm (6.3 x 9 x 11 in)
Weight	4.5 kg (10 lb)

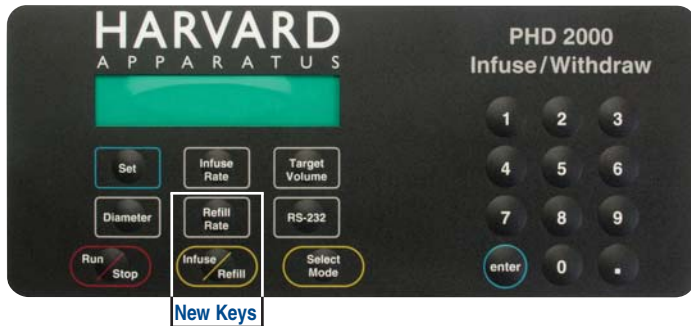
For ordering information, see page A15.

Precision Syringe Pumps



Infusion Only Models

This keypad is on all the infusion only models and offers a single pumping direction. It provides access to all the basic functions of the pump. It features a “Target Volume” button that permits the dispensing of a predefined volume. This is a nice feature when you want to dispense a specific volume. This mode is very safe because it protects syringes and will stop the pump automatically even if the user is not present.



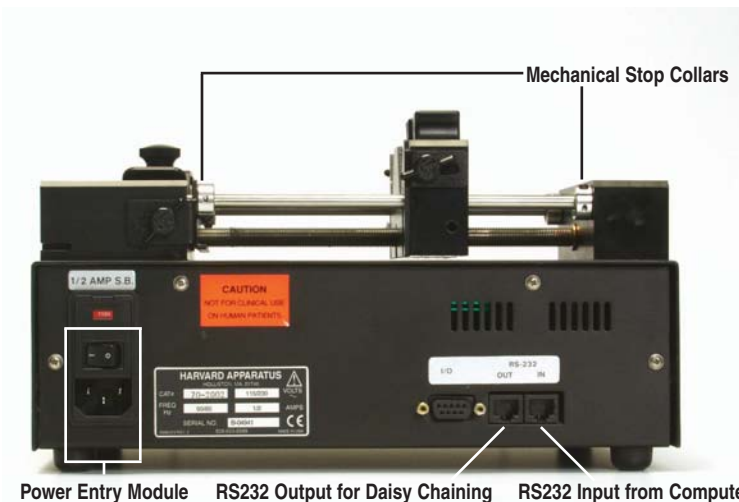
Infuse/Withdraw Models

With the addition of the “Infuse/Refill” and “Refill Rate” buttons on this keypad, the infuse/withdraw models permits the pusher block to move both forward and reverse. This allows the syringes to infuse and withdraw. The reversal is manually controlled via the keypad or RS232. For continuous delivery with automatic reversal see the programmable models below.



Programmable Models

This keypad has two additional buttons. The “Program” and “Auto Fill” buttons. With this pump you can actually program a sequence of pumping steps. You can start or stop the pump, change the pumping direction, change the flow rate, pump a precise volume and stop, pause the pump and even ramp up or ramp down the flow rate. All of these tasks can be linked together in a sequence providing a powerful tool to simplify and automate complicated pumping processes. The Auto Fill key is useful when user would like to deliver a large volume of fluid. The user sets a target volume and then programs the refill volume for the syringe. The pump will automatically refill the syringe as many times as required to reach the target volume. Then the pump will automatically stop. This process does require the use of a valve.



Rear Panel of the Pump

On the back side of all PHD 22/2000 Syringe Pump are two RS232 ports. One is for input from a computer and the second is for output when daisy chaining more than one pump together. The I/O port is a 9-pin D sub connector and is used for TTL control. Also on the back is the universal power entry module which encompasses the ON/OFF switch, fuse and universal power supply. This power supply will accept power input from 110 to 240 VAC, 50/60 Hz. The mechanical stop collars cause the pump to stop automatically, thus protecting expensive syringes.

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Harvard PHD22/2000 Advanced Syringe Pumps (Continued)

PHD 22/2000 Syringe Pumps												
Syringe Pump Versions	Infusion Only				Infuse/Withdraw				Programmable			
	Standard Force	\$	High Force	\$	Standard Force	\$	High Force	\$	Standard Force	\$	High Force	\$
Standard Syringe Pumps												
Standard 2-Syringe	BS4 70-2000		BS4 71-2000		BS4 70-2001		BS4 71-2001		BS4 70-2002		BS4 71-2002	
6/10 Multi-Rack	BS4 70-2003		BS4 71-2003		BS4 70-2006		BS4 71-2006		BS4 70-2009		BS4 71-2009	
4 x 140 Multi-Rack	BS4 70-2004		BS4 71-2004		BS4 70-2007		BS4 71-2007		BS4 70-2010		BS4 71-2010	
Microliter Rack	BS4 70-2005		BS4 71-2005		BS4 70-2008		BS4 71-2008		BS4 70-2011		BS4 71-2011	
Remote Syringe Pumps												
Standard 2 Syringe	BS4 70-2100		BS4 71-2100		BS4 70-2101		BS4 71-2101		BS4 70-2102		BS4 71-2102	
6/10 Multi-Rack	BS4 70-2103		BS4 71-2103		BS4 70-2106		BS4 71-2106		BS4 70-2109		BS4 71-2109	
4 x 140 Multi-Rack	BS4 70-2104		BS4 71-2104		BS4 70-2107		BS4 71-2107		BS4 70-2110		BS4 71-2110	
Microliter Rack	BS4 70-2105		BS4 71-2105		BS4 70-2108		BS4 71-2108		BS4 70-2111		BS4 71-2111	
Push/Pull Syringe Pumps												
Standard	-		-		BS4 70-2020		BS4 71-2020		BS4 70-2019		BS4 71-2019	
Remote	-		-		BS4 70-2120		BS4 71-2120		BS4 70-2119		BS4 71-2119	

Harvard PHD 22/2000 Pump Series		
Catalog No.	\$	Syringe Rack Kits and Upgrades
Syringe Rack Kits¹		
BS4 70-2012		PHD 22/2000 6/10 Multi-Rack Upgrade Kit
BS4 70-2013		PHD 22/2000 4 x 140 Multi-Rack Upgrade Kit
BS4 70-2014		PHD 22/2000 Microliter Rack Upgrade Kit
BS4 70-2015		PHD 22/2000 Anti-Siphon Kit (Infusion Only Pump)
Upgrades²		
BS4 70-2016		PHD 22/2000 Infusion to Infuse/Withdraw
BS4 70-2017		PHD 22/2000 Infuse/Withdraw to Programmable
BS4 70-2018		PHD 22/2000 Infusion Only to Programmable

1. These multiple syringe racks will fit any PHD 22/2000 series syringe pump listed above and are easily interchangeable.
2. Upgrades are available for Infusion Only and Infuse/Withdraw models of PHD 22/2000 series pumps. All upgrades must be factory installed.

For Symphony Software, see page A17.

For Accessories, see page A19.

For GASTIGHT[®] Syringes, see pages A73 and A74.

For Plastic Syringes, see pages A76 and A77.

For Stainless Steel Syringe, see page A70.

For Tubing, see pages A78 to A87.

For Luer Connectors and Kits, see pages A88 to A91.

Continuous Flow Tubing Segment

This continuous flow tubing segment is used with the PHD 22/2000 Push/Pull Syringe Pump. It makes continuous flow possible.

Specifications

Tubing	0.062 in. ID Tygon [®] tubing
Tubing Length	3 x 112 in. sections
Max. Pressure	15 p.s.i.
Valve Materials	Polycarbonate, silicone

Catalog No.	\$	Product
BS4 61-0270		Continuous Flow Tubing Segment

Remote Extension Cables

Replacement cables for PHD 22/2000 remote syringe pumps including the PHD 22/2000 Hpsi, see page A16. The cables can also be used to increase or decrease the distance between the pump mechanism and controller.

Catalog No.	\$	Product
BS4 72-0199		Remote Extension Cable, 1.5 m (5 ft)
BS4 72-1405		Remote Extension Cable, 9.1 m (30 ft)

We also offer Symphony, a Windows[™] based pump managing program that allows you to program the pump easily from your computer; see page A17 for complete details.