

NEW PRODUCT

PHD ULTRA^{SERIES}

Quick Start

Method Select

Quick Start: Infuse/Withdraw

Syringe Select

HA steel, 4.851 mm, 2.5 ml

Infuse Rate Select

3.525 ml/min

Withdraw Rate Select

3.525 ml/min

Target Volume Select

2.5 ml

HARVARD APPARATUS

04/28/09 12:11:56 PM

Enter your settings to the left and then press the green Run or Run Preview button when finished. Make sure to set a target volume.



HARVARD
APPARATUS

- **% COMPOSITION STEP CHANGES**
- **I/O INTERACTIVE EXPERIMENTS**
- **DRUG/NUTRITIONAL INFUSIONS**
- **FLOW PROGRAMMING**
- **CONTINUOUS FLOW**
- **FEEDING CELLS**
- **GRADIENTS**
- **NANOFLUIDICS**
- **ELECTRO SPINNING**
- **LARGE FLOW DELIVERIES**
- **MASS SPEC CALIBRATION**
- **REACTION CHAMBER ADDITION**
- **LOW PRESSURE CHROMATOGRAPHY**

THE **ULTIMATE PUMP** FOR SOLVING YOUR **APPLICATION**

the PHD ULTRA™ technology goals

HARVARD APPARATUS

Harvard Apparatus is proud to introduce the new PHD ULTRA™ syringe pump. The PHD ULTRA™ sets a new standard of performance in syringe pumps for smooth, accurate and precise flow. Harvard Apparatus introduced the first commercial syringe pump in 1956 and has been involved in advanced fluidics for over 108 years. Harvard Apparatus continues to be the global leader in high-performance syringe pumps with the PHD ULTRA™, designed for the demanding Ultra Fluidics™ applications of the future.



Solve your fluidics applications with Ultra Fluidics™ from Harvard Apparatus!

Harvard Apparatus utilized a three part approach to solve the challenges of Ultra Fluidics™ that result in a series of new features assuring a successful solution to applications from the simplest to the most complex.

ADVANCED MECHANICS

NEW ADVANCED PATENTED* FLOW CONTROL MECHANICS

- Syringe holding mechanics for easier use and more performance

NEW EZ PRO™ SOFTWARE

- Easy-to-use GUI interface
- Advanced color touch screen display
- Advanced methods architecture
- Preprogrammed quick start and advanced methods
- Alphanumeric reporting capability

NEW MAXIMUM VERSATILITY

- Advanced configurations of racks and flow rates
- Versatile selection of models
- Largest selection of accessories
- Superior connectivity options
- Advanced fluidics features

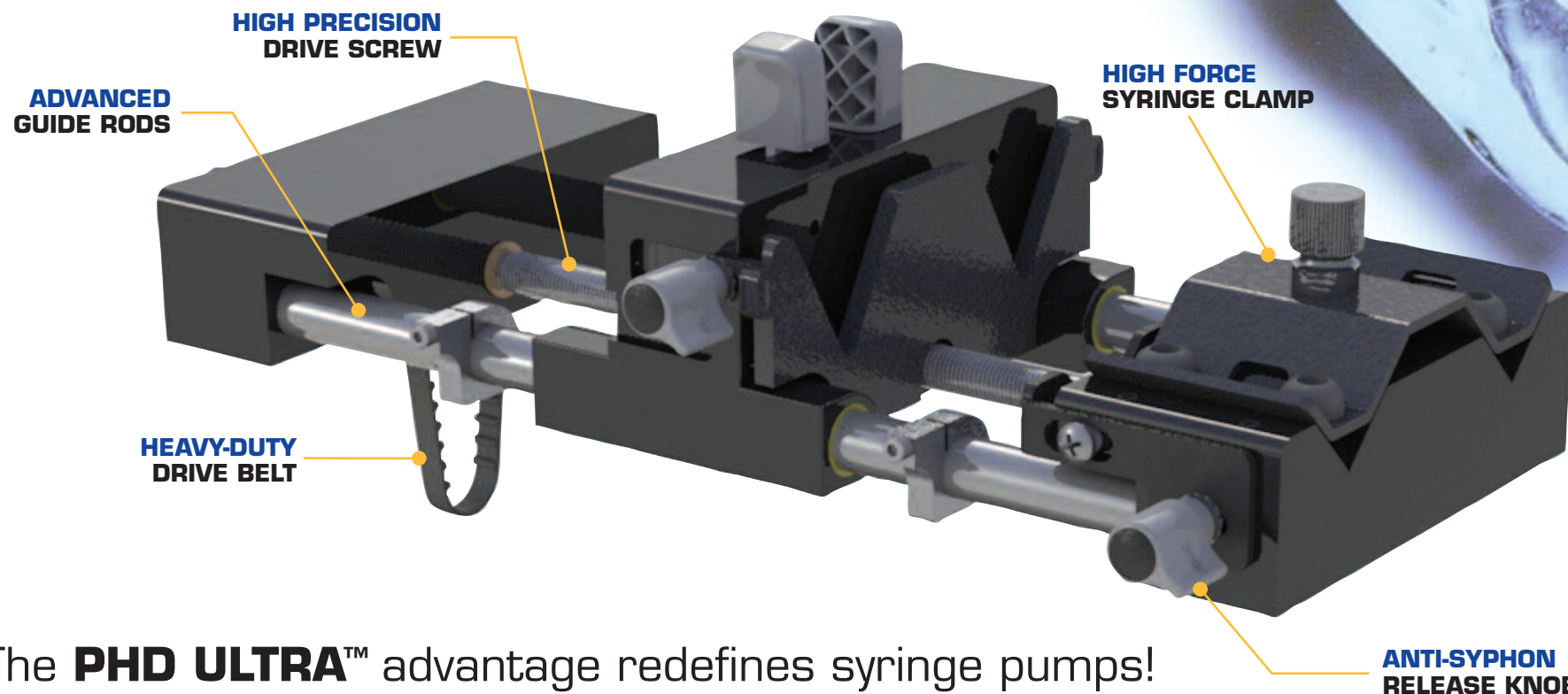
EZ PRO™
SOFTWARE

ADVANTAGE
PHD ULTRA™
SERIES

MAXIMUM
VERSATILITY

ADVANCED

patented* mechanical design
assures high performance and
EZ use



The **PHD ULTRA™** advantage redefines syringe pumps!

The **FIRST ADVANCEMENT** is a new patented* mechanical design for the highest performance flow of any syringe pump. Advanced mechanical translation technology from the highest tolerance drive screws to superior bearing design, combined with advanced motor microstepping allows the PHD ULTRA™ to produce maximum flow smoothness and accuracy across the broadest range of flows available.

The standard PHD ULTRA™ delivers 75 pounds of linear force across the entire range of flow. It has the power to maintain its great flow characteristics even with viscous solutions or multiple syringes on a rack. Other PHD ULTRA™ Models are available with up to 433 pounds of force for your most demanding conditions.

The PHD ULTRA™ syringe racks are constructed of rolled steel to maintain a warp free shape that eliminates the thermal expansion errors of conventional aluminum racks. This assures excellent long term performance and reliability. Lastly, the advanced front mounted controls and mechanics make loading syringes an easy task.

*Patent pending



EZ PRO™

software makes a complex
tasks EZ without a PC

The **SECOND ADVANCEMENT** of PHD ULTRA™ is the EZ PRO™ interface. Immediate access to the Quick Start and Advanced program templates and methods wizards provide a new operational simplicity. By programming custom methods into the pump, multi-user errors are reduced. Easily transfer complex methods to other pumps and/or download methods from a PC. Forget having to duplicate method-development efforts for each new pump added to your system.

- Advanced high resolution touch screen with GUI interface and icons makes the PHD ULTRA™ EZ to operate
- Alphanumeric keyboard for methods naming, experimental conditions, and operators names

Capability
controlled
with a touch
of your finger!

Programming



Advanced
System
Monitors



Quick Start



Communications (I/O, RS-485, RS-232, TTL)



Method Names
(Alphanumeric)



EZ PRO™ SOFTWARE

advanced programming methods
with the touch of a button!

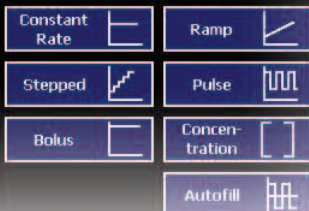
FLOW PROGRAMMING

Select Profile for Step 1

HARVARD APPARATUS

04/28/09 1:21:10

DURATION



- Change the flow with time and volume
- Trigger an event as many times as you like

Select the desired step profile, press the Enter button (next to the profile) to accept your settings, or press the Cancel button (next to the profile) to return to the previous screen.



FLOW
FUNCTION

END
FLOW

BOLUS

Step # 4, Bolus

HARVARD APPARATUS

04/28/09 1:28:28

Set Rate

Rate: 106 ml/min

Set Target Volume

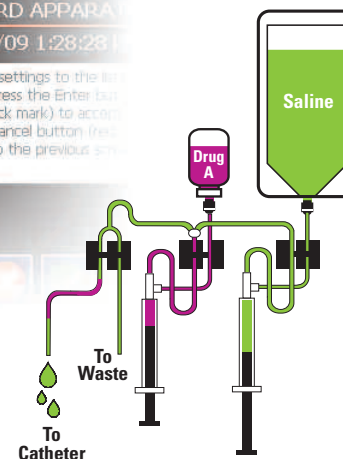
0 ml

Volume

Time

Enter your settings to the left, then press the Enter button (green check mark) to accept your settings, or press the Cancel button (red X) to return to the previous screen.

- Injection of a drug (or drugs) in high quantity at once
- Select bolus mode and program infusion bolus variables
- The bolus injection can be made in time or volume



CONCENTRATION MODE

Step # 1, Concentration

HARVARD APPARATUS

04/28/09 1:29:16

Animal Weight

0 (grams)

Set Rate And Concentration

0 (mg/ml)

Set Dose or Duration

0 (mg/kg) 0 second(s)

Set # Doses & Time Between Doses

0 Dose(s) 0 second(s)

Enter your information to the left, then press the Enter button (green check mark) to accept your settings, or press the Cancel button (red X) to cancel your settings and return to the previous screen.



- Easily calibrate flow in concentration units of mg/kg
- Calibrate to concentration of drug and animal weight

GRADIENT CAPABILITY

Set Baud Rate

HARVARD APPARATUS

04/28/09 11:59:30

9600

19200

38400

57600

115200

Select a baud rate to the left, then press the Enter button (green check mark) to accept your settings, or press the Cancel button (red X) to cancel your settings and return to the previous screen.



- The PHD ULTRA™ can be preprogrammed to deliver gradients to investigate drug dosing, reaction vessel catalyst additions, solvent changes for chromatography



VERSATILITY

of configurations
to optimize your
experimental set-up

The **THIRD ADVANCEMENT** of the PHD ULTRA™ is the new maximum versatility of design to work in the horizontal or vertical position. The advanced touch screen senses the orientation and switches automatically.

- **Horizontal Orientation** is for minimum dead volume experiments that are lab bench height
- **Vertical Orientation** requires minimal bench space and is for easy bubble clearance. It also reduces the dead volumes need for vertical experiments



**HORIZONTAL
ORIENTATION**



**VERTICAL
ORIENTATION**



UNPARALLELED

experimental versatility

The PHD ULTRA™ is the first high performance, programable pump with EZ to program capabilities. Many functions that used to require a PC are possible without a PC. The new patented* mechanical design makes the PHD ULTRA™ superior in accurate, precise and smooth flow performance.

Unparalleled fluidics operational modes across the widest flow rate range available

- **Single or Multi-Syringe Mode:** from 0.5µl to 140ml syringes pumping at a range of 0.0001µl/hr to 220.82 ml/min; 2 syringes; 4 syringes; 6 syringes; 8 syringes; 10 syringes
- **Continuous Flow:** set single flow rate or volume
- **Flow Programming:** ability to program multiple flow rates with time or volume
- **Step Gradient:** % composition step changes
- **Continuous Gradient:** binary or ternary gradients
- **Bolus Injection:** by time or volume
- **Concentration Mode:** flow delivered in mg/kg adjusted for animals weight
- **Interactive Experiments:**
 - a. Time - start or stop events on built-in, real or relative time clocks
 - b. Touch Screen Keyboard - push button or foot pedal to start and stop
 - c. PC-RS-232, RS-485, USB-connect to a computer
 - d. I/O +/-5V have the pump start or stop a program with a signal from pH, balance, reward platform, biosensor, etc...
- **Autofill:** synchronize of two pumps, each having an external reservoir connected to the syringe. One pump infuses until the syringe is empty, then the second pump starts pumping to maintain the flow while the first pump refills. This alternating process repeats creating continuous flow.
- **Pulse Profile:** set-up a continuous pulsing flow

Syringe Selection

Custom Syringe	
Air-Tite HSW Norm-Ject	↑
Becton Dickinson Glass (all types)	▲
Becton Dickinson Plasti-pak	▼
Hamilton Glass (all types)	↓
Harvard Apparatus Stainless Steel	
Cadence Science, Inc. Perfektum Glass	⬇

HARVARD APPARATUS
04/28/09 12:22:22 PM

Select an existing syringe manufacturer or select custom syringe and then press Enter (green check mark) to accept or press the Cancel button (red X) to return to the previous screen.

Select Profile for Step 1

Constant Rate 	Ramp 
Stepped 	Pulse 
Bolus 	Concentration 
Autofill 	

HARVARD APPARATUS
04/28/09 1:21:10 PM

Select the desired step profile or press the Cancel button (red X) to return to the previous screen.

Advanced Options 

Step # 4, Pulse

Set Mode Infuse 

Set Rates
Rate 1: 0 ml/min Rate 2: 0 ml/min

Set Volume
0 ml

☐ Volume ☒ Time

of Pulses
0 Pulse(s)

HARVARD APPARATUS
04/28/09 1:25:31 PM

Enter your settings to the left and then press the Enter button (green check mark) to accept or press the Cancel button (red X) to return to the previous screen.



MAXIMUM

versatility of configurations, models and connectivity

Connectivity with RS-485 can be used to daisy chain for remote operation, ganging pumps, gradients, or what ever your requirements. These methods can be tripped by the controlling pump or a PC using the USB or RS-232 ports.

The PHD ULTRA™ has various configurations: push-pull, high force, remote and standard. The I/O allows you maximum versatility so you can pump rewards, respond to physiological changes, connect balances and more.



PUSH/PULL



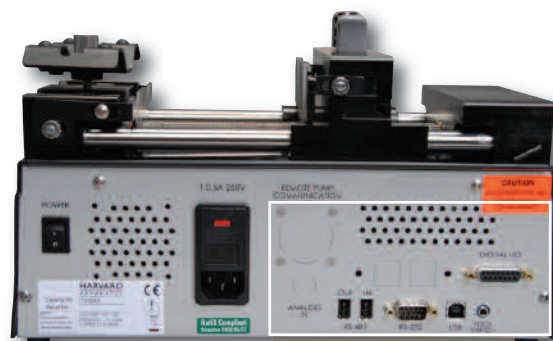
4 x 140 MULTI-RACK



6 x 10 MULTI-RACK



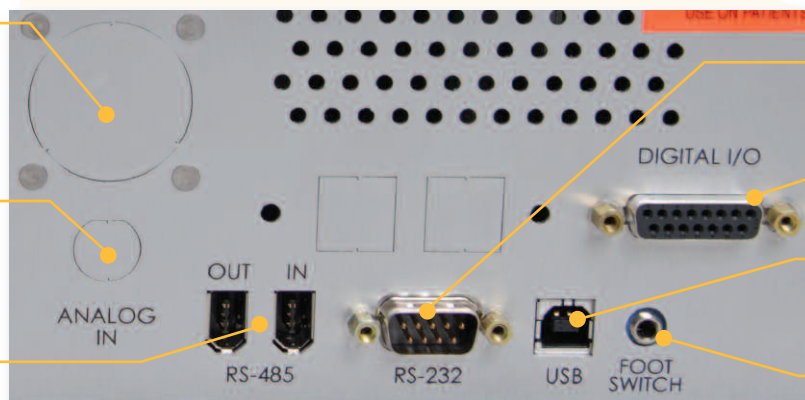
MICROLITER MULTI-RACK



CONNECTOR FOR REMOTE MECHANISM
(optional)

ANALOG CONTROL CONNECTOR
(optional)

RS-485 CONNECTORS
(for pump-to-pump communication)



RS-232 SERIAL CONNECTOR
(for communication from PC)

USER I/O CONNECTOR

USB SERIAL INPUT
(for communication from PC)

FOOTSWITCH INPUT
(switch sold separately)



DAISY CHAIN WITH RS-485



ACCESSORIES

for versatile experiments

Temperature Control

Depending upon the experiment, multiple levels of temperature control may be required. Harvard Apparatus can provide heating and cooling for chips, lines, syringes and microscopes.

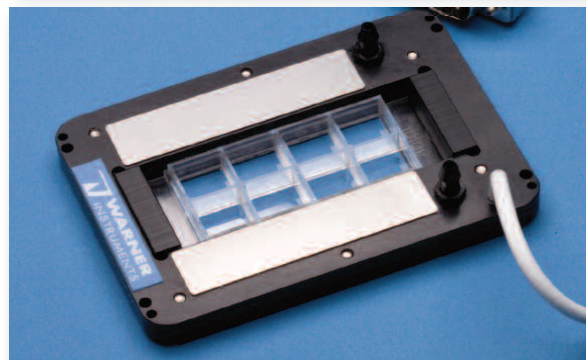
WP-10 and WP-16 Warmed Platforms

- Stage Adapters for all major brands
- Microscopes for low cost systems



SH-27B & SF-28 Single Inline Solution Heaters

- Small size allows placement close to imaging and recording chamber to minimize convective heat losses
- Single line in-line solution heaters include T1 thermistor embedded within aluminum housing for feedback control
- Designed to operate with TC-324B or TC-344B temperature controllers
- Output temperature from ambient to 50°C



CO₂ Microscope Stage Incubator

- One model fits all XY stages
- Suitable for high-magnification microscopy
- Temperature control from Ambient +3° to 50°C
- Wide selection of cell cultures support adapters



Syringe Heater

Solution reservoir heating is an important technique used to eliminate out gassing of solutions prior to their entry to a heated perfusion chamber. Since the gas load of a solution is dependent on partial pressure and temperature, preheating the solution at atmospheric pressure before delivery to the final heater will minimize the occurrence of bubbles in the chamber's bath, even if the solution is allowed to cool on route. The ability to independently control each separate heater block allows the researcher to control the initial temperature of each solution without influencing other nearby solutions.

Accessories

- Nanofluidic Chips
- Tubing
- Connectors
- Syringes
- Needles
- Emulsifying Needles
- Sonic Syringe
- Spill Sensor



the PHD ULTRA™

the advantage in
solving your fluidic
experiments!

DISPENSERS & INJECTORS

Ideal for a multitude of
dispensing and injecting
applications

- Adhesive
- Cell injection
- MRI dyes
- Activators/Enzymes
- Flow injection
- Microreaction vessels
- Stereotaxic delivery

MICRO & NANO FLUIDICS

μl, nano & picoliter flow,
pulseless flow

- Lab-on-a-chip
- Bubble reactors

SYRINGE PUMPS

FOR YOUR MOST
DEMANDING
APPLICATIONS!

- Injecting into high pressure
reaction vessels
- Multiple simultaneous animal
feeding stations
- Micro and nanofluidics down
to picoliter flows
- HPLC delivery system
- Remote operation in
hazardous
environments
- Electro spinning,
Biomimicing
spider web...

AEROSOL FOR COATING

At high pressure, the pump
creates an aerosol for the
delivery of coating materials

- Pharmaceutical tablets
- Aerosol studies

PROPORTIONING & DELIVERING OF MIXTURES

Mixing gradients or
proportions with
independent control
of two liquids

- Dial-a-mix
- Independent 2
pump control

ANIMAL INFUSIONS OR WITHDRAWALS

The control of pumps delivering
varying % of nutrients or drugs
infused into animals, flush
lines and withdraw

- Catheters
- Needles
- Cannulae
- Micro Dialysis

DELIVERY OF MASS SPECTROMETRY

Delivery of fluids to the MS

- Calibration
- Matrix addition
- ESI sample

COMPENSATING FLOWS

The continuous infusion
and simultaneous
withdrawal of liquids

- Cell cultures
- Perfusion chambers



ADVANCED

characteristics for
picoliter to milliliter flows...
smoother, precise flow rates

PHD ULTRA™ Specifications

Accuracy	± 0.35%
Reproducibility	± 0.05%
Syringes (Min./Max.)	0.5 µl / 140 ml
Flow Rate:	
Minimum (0.5 µl syringe)	1.56 pl/min
Maximum (140 ml syringe)	220.97 ml/min
Display	4.3" WQVGA TFT Color Display with Touchpad
Non-Volatile Memory	Stores all settings
RS-232 Connectors	9 pin D-Sub Connector
USB Connectors	Type B
I/O & TTL Connectors	15 pin D-Sub Connector
Linear Force (Max)	34 kg (75 lbs) @ 100% Force Selection
Drive Motor	0.9° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping
Number of Microsteps per one rev. of Lead Screw	12,800
Step Rate:	
Minimum	27.5 sec/µstep
Maximum	26 µsec/µstep
Pusher Travel Rate:	
Minimum	0.18 µm/min
Maximum	190.80 mm/min
Power	100 to 240 VAC: 50/60 Hz 50 W, 0.5 A fuse
Dimensions	10.16 x 21.59 x 30.48 cm (4 x 8.5 x 12 in)
Weight	4.5 kg (10 lb)
Atmospheric Specifications	
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Humidity	20% to 80% RH, non-condensing
Mode of Operation	Continuous
Classification	Class I
Pollution Degree	1
Installation Category	II
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS

PHD ULTRA™ Ordering Information

Order #	Order #	Product
Stand Alone	Remote	
Standard Version		
70-3005	70-3105	PHD ULTRA™ Infuse Only
70-3006	70-3106	PHD ULTRA™ Infuse/Withdraw
70-3007	70-3107	PHD ULTRA™ Infuse/Withdraw Programmable
Push/Pull Versions		
70-3008	70-3108	PHD ULTRA™ with Push/Pull Mechanism
70-3009	70-3109	PHD ULTRA™ Programmable with Push/Pull Mechanism
Other Versions		
70-3010	70-3110	PHD ULTRA™ 4400 Syringe Pump I/W Programmable
—	70-3111	PHD ULTRA™ Remote Hpsi Syringe Pump I/W Programmable
—	70-3112	PHD ULTRA™ Remote Hpsi Syringe Pump I/W Programmable with 10x140 Rack
70-3030	—	PHD ULTRA™ Option RS-232 RJ-11 Connectors
70-3033	—	PHD ULTRA™ Option Analog Control Input
70-3031	—	PHD ULTRA™ Option Internal Pinch Valve
70-3032	—	PHD ULTRA™ Option Internal 3-way Isolation Valve
70-3034	—	PHD Ultra Infuse Only with Fan

Specials available on request for different racks, custom flow ranges and flow characteristics in those ranges, special accessories.

Order # Product

Upgrades

70-3020A	6x10 Multi Syringe Rack for PHD ULTRA™
70-3021A	4x140 Multi Syringe Rack for PHD ULTRA™
70-3022A	Micro Dialysis Rack, for PHD ULTRA™ holds 4 syringes
70-3023	Anti-Siphon Kit for PHD Ultra
70-4010	Upgrade Infuse Only to I/W *
70-4011	Upgrade Infuse Only to Programmable *
70-4012	Upgrade I/W to Programmable *

*Requires Return to Factory

Order # Product

Accessories

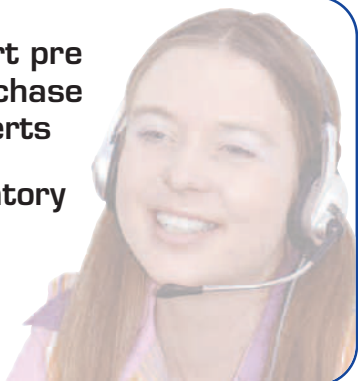
70-4000	RS-485 Cable for Pump-to-Pump Communication, 0.5m
70-4001	RS-485 Cable for Pump-to-Pump Communication, 2 m
70-4002	USB Cable for PC-to-Pump Communication, 2 m
70-4003	USB Cable for PC-to-Pump Communication, 5 m
70-4004	RS-232 Cable for PC-to-Pump Communication, 9 pin D-sub, 2 m
72-0199	Remote Extension Cable, 1.5 m (5 ft)
72-1405	Remote Extension Cable, 9.1 m (30 ft)
70-4005	Adapter, PHD Digital I/O
70-4006	Adapter, D-sub 15 to Term. Blk
72-8340	Adapter, USB to Serial
70-2215	Footswitch (w/ Phono Plug)
55-7002	Auto Fill Valve Box, Normal Pressure, 30 psi
55-7004	Auto Fill Valve Box, High Pressure, 200 psi
55-7760	Cable Assy, Daisy-chain, Legacy RS-232 RJ-11, 2 ft
72-2478	Cable Assy, Daisy-chain, Legacy RS-232 RJ-11, 7 ft
2401-086	Adapter for 25ml, 50ml, 100ml Hamilton GasTight™ Syringes
5153-209	Line Cord



HARVARD APPARATUS

Exceptional Technical Support

- Global support pre and post purchase by pump experts
- Global Regulatory Compliance: CB SCHEME, EU RoHS, CSA, CE, UL



Corporate Headquarters

UNITED STATES



Harvard Apparatus

Attn: Customer Service
84 October Hill Road
Holliston, Massachusetts 01746, USA

phone **508.893.8999**

toll free **800.272.2775** (USA Only)

Fax **508.429.5732**

e-mail **bioscience@harvardapparatus.com**

website **www.harvardapparatus.com**

Harvard Apparatus Sales Offices

CANADA



Harvard Apparatus Canada

Attn: Sales Department
6010 Vanden Abeele
Saint-Laurent, Quebec, H4S 1R9, Canada

phone **514.335.0792 • 800.361.1905** (Canada only)

fax **514.335.3482**

e-mail **sales@harvardapparatus.ca**

website **www.harvardapparatus.ca**

GERMANY



Hugo Sachs Elektronik Harvard Apparatus, GmbH

Gruenstrasse 1
D-79232 March-Hugstetten, Germany

phone **49.7665.92000**

fax **49.7665.920090**

e-mail **info@hugo-sachs.de**

website **www.hugo-sachs.de**

UNITED KINGDOM



Harvard Apparatus, Ltd.

Attn: Sales Department
Fircroft Way, Edenbridge
Kent TN8 6HE, United Kingdom

phone **44.1732.864001**

fax **44.1732.863356**

e-mail **sales@harvardapparatus.co.uk**

website **www.harvardapparatus.co.uk**

FRANCE



Harvard Apparatus, S.A.R.L.

Attn: Sales Department
6 Avenue des Andes
Miniparc – Bat. 8
91952 Les Ulis Cedex, France

phone **33.1.64.46.00.85**

Fax **33.1.64.46.94.38**

e-mail **info@harvardapparatus.fr**

website **www.harvardapparatus.fr**

SPAIN



Panlab, S.L. Harvard Apparatus Spain

C/Energia, 112
08940 Cornellà, Barcelona
Spain

phone **34.934.750.697** (International Sales)

phone **934.190.709** (Sales in Spain)

fax **34.934.750.699**

e-mail **info@panlab.com**

website **www.panlab.com**

