PHD ULTRA™ Nanomite

& PHD ULTRA™ NanoCool

User's Guide

PHD ULTRA™ Nanomite Series   MA1 70-3601
PHD ULTRA™ NanoCool Series   MA1 88-1050

PATENTS PENDING

Harvard Apparatus

For GUI operation, refer to PHD ULTRA user manual 5419-002

Table of Contents

General Information

CONVENTIONS USED IN THIS GUIDE

This guide describes basic procedures for operating the PHD ULTRA™ Nanomite Syringe Pump hardware operations. Refer to the PHD ULTRA manual for software instructions. This section discusses important conventions used in this guide.

Capitalization

All menus, commands, and dialog box option names appear with initial capital letters whether or not they are completely capitalized in the user interface. This includes navigation buttons and menu selection buttons/selection lists on the touchscreen display. This will help you to distinguish these items from narrative or procedural text.

Terminology

Throughout the PHD ULTRA™ Nanomite documentation, the following terms are used to refer to program elements and the actions that you perform to carry out tasks:

- **Method** — A Method is the collection of steps and parameters that constitute the operating instructions to the pump while being used to infuse or withdraw liquids.

- **Choose** — The terms *choose* and *select* indicate actions that you perform using the touchscreen interface. Choose represents carrying out an action associated with a parameter or navigation button.

  Choose will be used when the choice you make is automatically executed. For example, "Choose the Method Select" button automatically brings you to the Method Selection screen on the touchscreen. When you are likely to use the touchscreen to enter alphanumeric data (e.g. a Method name or a parameter numerical value through a simulated keyboard or number pad), the specific key is mentioned, or we indicate you should "enter" your desired values.

- **Select** — The term *select* refers to highlighting an item or moving the button focus on the touchscreen. Selecting an item prepares it for an action and requires a second touch on the touchscreen to confirm the selection. For example, when you "select" the Syringe Manufacturer/Brand on the Syringe Selection screen, it is first highlighted in magenta. Pressing the selected choice a second time confirms/accepts the selection. You can also press the Accept button to confirm the selection. We will use the term "select" to refer to this double-press or press/confirm action throughout this guide.

Illustrations

Unless otherwise indicated, the values in the illustrations of this manual are examples only. They are not intended to indicate the exact values you will see or to suggest the values you should use.

Special Messages/Callouts

The following special messages and callouts appear throughout the guide to indicate information that requires special attention:

Warnings or hazard instructions provide information to help you avoid personal injury or damage to the PHD ULTRA™ Nanomite Pump during operation.

Notes provide helpful instructions that can help you make better use of the PHD ULTRA™ Nanomite pump.

WARRANTY AND REPAIR INFORMATION

⚠️ **CAUTION:** Refer to safety information and setting up the PHD ULTRA™ Nanomite before plugging in PHD ULTRA™ Nanomite pump.

Manual Description

This manual is designed to provide all operational and program information required to operate and maintain the PHD ULTRA™ Nanomite. The functions and features are described in the Technical Specifications section.

Warranty

Harvard Apparatus warranties this instrument for a period of two years from date of purchase. At its option, Harvard Apparatus will repair or replace the unit if it is found to be defective as to workmanship or materials. This warranty does not extend to damage resulting from misuse, neglect or abuse, normal wear and tear, or accident. This warranty extends only to the original consumer purchaser.

IN NO EVENT SHALL HARVARD APPARATUS BE LIABLE FOR INCIDENTAL OR CONSEQUENTIAL DAMAGES. Some states do not allow the exclusion or limitation of incidental or consequential damages so the above limitation or exclusion may not apply to you. **THERE ARE NO IMPLIED WARRANTIES OF MERCHANTABILITY, OR FITNESS FOR A PARTICULAR USE, OR OF ANY OTHER NATURE**. Some states do not allow this limitation on an implied warranty, so the above limitation may not apply to you.

If a defect arises within the two-year warranty period, promptly contact **Harvard Apparatus, 84 October Hill Road, Holliston, Massachusetts 01746** using our toll free number 1-800-272-2775, or outside the U.S. call 508-893-8999. Email Address is bioscience@harvardapparatus.com. Goods will not be accepted for return unless an RMA (returned materials authorization) number has been issued by our customer service department. The customer is responsible for shipping charges for non-warranty repairs. Please allow a reasonable period of time for completion of repairs or replacement. If the unit is replaced, the replacement unit is covered only for the remainder of the original warranty period dating from the purchase of the original device.

This warranty gives you specific rights, and you may also have other rights which vary from state to state.

Repair Facilities and Parts

Harvard Apparatus stocks replacement and repair parts. When ordering, please describe parts as completely as possible, preferably using a part number obtained from our Technical Support department. If practical, enclose a sample part or sketch. We offer a complete reconditioning service.

Serial Numbers

All inquiries concerning our product should refer to the serial number of the unit, located on the rear panel.

Calibrations

All electrical apparatus are calibrated at rated voltage and frequency. While the flow and volume will stay calibrated, the peak pressure may vary. Harvard Apparatus recommends an annual calibration of the pump.

⚠️ **CAUTION:** For research use only. Not for clinical use on patients.

SAFETY INFORMATION

Please read the following safety precautions to ensure proper use of your syringe pump. If the equipment is used in a manner not specified, the protection provided by the equipment may be impaired.

To Prevent Hazard or Injury:

Use Proper Line Cord

Use only the specified line cord for this product and make sure line cord is certified for country of use. The operating voltage range for the PHD ULTRA™ Nanomite is 100-240 vac, 50-60 Hz.

Ground the Product

This product is grounded through the grounding conductor of the power cord. To avoid electric shock, the grounding conductor must be connected to earth ground. Before making any connections to the input or output terminals of the product, ensure that the product is properly grounded.

Make Proper Connections

Make sure all connections are made properly and securely. Any signal wire connections to the unit must be no longer than 3 meters (except RS485 pump-to-pump communication cable).

Observe All Terminal Ratings

Review the operating manual to learn the ratings on all connections.

Use Proper Fuse

Use only specified fuses with product.

Avoid Exposed Circuitry

Do not touch any electronic circuitry inside of the product.

Avoid Pinch Hazard

A pinch hazard may exist between the pusher block and end blocks. Avoid placing fingers between these points while the pump is running.

Do Not Operate with Suspected Failures

If damage is suspected on or to the product do not operate the product. Contact qualified service personnel to perform inspection.

Orient the Equipment Properly

Do not orient the equipment so that it is difficult to manage the connection and disconnection of devices.

Place Product in Proper Environment

Review the operating manual for guidelines for proper operating environments.

Observe all Warning Labels on Product

Read all labels on product to ensure proper usage.

*CAUTION
Refer to Manual*

*Protective Ground
Terminal*

Introduction To The PHD ULTRA™ Nanomite Pump

PRODUCT OVERVIEW – THEORY OF OPERATION

The PHD ULTRA™ Nanomite Syringe Pump is a high-accuracy pump designed for versatile technical use including cellular injections, fluid sampling, drug delivery, microinjections, hand-held automated delivery, regenerative medicine and stereotaxic injections. The PHD ULTRA™ Nanomite incorporates a microprocessor controlled, small step angle stepping motor that drives a lead screw and Pusher Block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation. The pump is engineered to provide flow accuracy within 0.50% and reproducibility within 0.05%.

The PHD ULTRA™ Nanomite uses a touchscreen interface and advanced software to control operation. External I/O interfaces permit external control via an independent computer or device. The application software provides convenient selection of common syringe models from a Syringe Lookup Table, as well as insertion of custom syringe specifications. The system is then able to calculate the cross-sectional area of the syringe selected and calibrate the flow rate and volume accumulation, displaying real-time operating characteristics via on-screen graphics.

PUMP MODEL

NANOMITE

Infusion/Withdrawal Programmable: This model supports both infusion and withdrawal operations, and can use both simpified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. This model also allows users to create and store multiple user-defined Methods on the pump.

NANOCOOL

Nanomite pump with the addition of a peltier cooled syringe holder, making it ideal for use with cellular suspensions, biologicals or virtually any temperature dependent solution. Initiation of injection via footswitch makes the NanoCool particularly useful for precision stem cell injections.
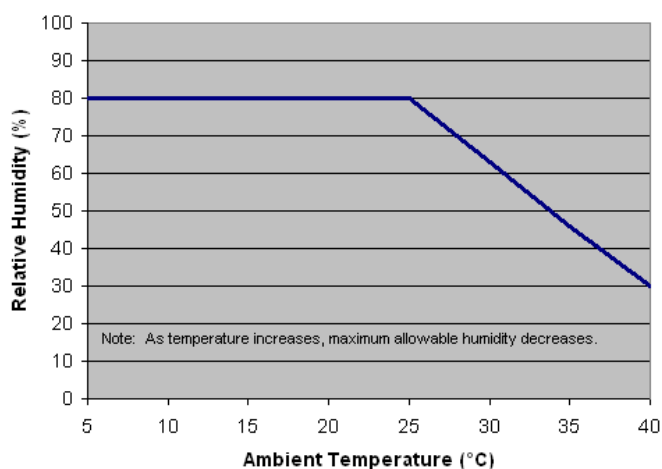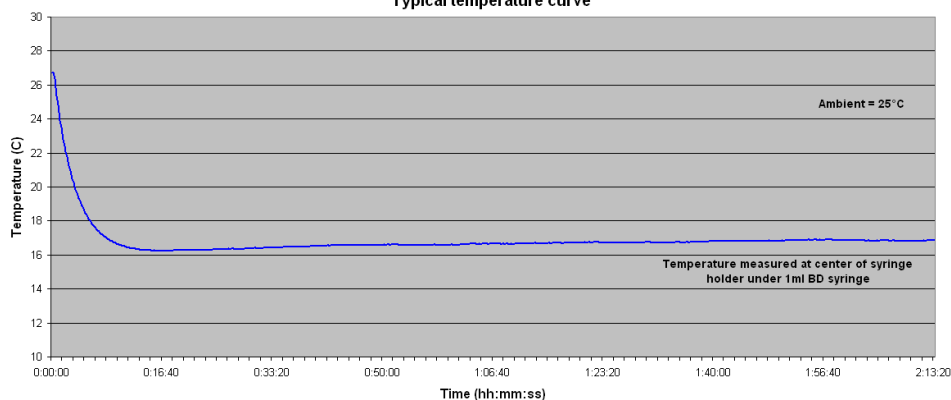
PHD ULTRA™ Nanomite Specifications

	Nanomite	NanoCool Injector
Flow Accuracy	± 0.5%	± 0.5%
Flow Reproducibility	± 0.05%	± 0.05%
Temperature	N/A	< 18° C
Minimum Syringe	0.5 µl	10 µl
Maximum Syringe	1000 µl	1000 µl (Gas-Tight) ; 1 ml (plastic)
Flow Rate:		
Minimum	3.66000 pl/min (0.5 µl syringe)	367.400 pl/min (10 µl syringe)
Maximum (1 ml syringe)	3.82039 ml/min	3.82039 ml/min
Display	4.3" WQVGA TFT Color Display w/Touchscreen	4.3" WQVGA TFT Color Display w/Touchscreen
Non-Volatile Memory	Stores all settings	Stores all settings
Connectors:		
RS-232	9 pin D-Sub Connector	9 pin D-Sub Connector
RS-485	IEEE-1394, 6 pos	IEEE-1394, 6 pos
USB	Type B	Type B
I/O & TTL	15 pin D-Sub Connector	15 pin D-Sub Connector
Footswitch	Mini phono jack	Mini phono jack
Linear Force (Mac):	5 kg (11 lbs) @ 100% Force Selection	5 kg (11 lbs) @ 100% Force Selection
Drive Motor	1.8° Stepper Motor Controlled	1.8° Stepper Motor Controlled
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Number of Motor Micro Steps per one rev. of Lead Screw Step Resolution	3,200	3,200
Step Resolution	0.198 µm/µstep	0.198 µm/µstep
Step Rate:		
Minimum	27.5 sec/µstep	27.5 sec/µstep
Maximum	52 µsec/µstep	52 µsec/µstep
Pusher Travel Rate:		
Minimum	0.433 µm/min	0.433 µm/min
Maximum	228.97 mm/min	228.97 mm/min
Power	100-240 VAC:50/60 Hz, 75 W, 0.5 A fuse	100-240 VAC:50/60 Hz, 75 W, 0.5 A fuse
Dimensions		
Control Box	12.0 x 8.5 x 4.38 in (30.5 x 21. 6 x 11.1 cm)	12.0 x 8.5 x 4.38 in (30.5 x 21. 6 x 11.1 cm)
Injector Unit	2.5 x 2.0 x 7.5 in (6.35 x 5.08 x 19.05 cm)	8 x 2 x 2 in (20.3 x 5.1 x 5.1 cm)
Weight:		
Control Box	2.06 kg (4.55 lbs)	2.06 kg (4.55 lbs)
Injector Unit	.458 kg (1.01 lbs)	.463 kg (1.02 lbs)

PHD ULTRA™ Nanomite Specifications

	Nanomite	NanoCool Injector
Atmospheric Specifications:		
Operating Temperature	4°C to 40°C (40°F to 104°F)*	4°C to 40°C (40°F to 104°F)*
Storage Temperature	-10°C to 70°C (14°F to 158°F)	-10°C to 70°C (14°F to 158°F)
Operating Humidity	See Chart Below	See Chart Below
Storage Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Mode of Operation	Continuous	Continuous
Classification	Class I	Class I
Pollution Degree	1	1
Installation Category	II	II
Supplier Name	Harvard Apparatus	Harvard Apparatus
Supplier Address	84 October Hill Road, Holliston, MA 01746	84 October Hill Road, Holliston, MA 01746
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, WEEE, EU RoHS
Safety Declarations	ANSI/UL 61010-1 Ed. 3 ; CAN/CSA C22.2 No. 61010-1 Ed. 3 ; IEC 61010-1 Ed. 3 ; CENELEC EN 61010-1 ; CB Scheme	ANSI/UL 61010-1 Ed. 3 ; CAN/CSA C22.2 No. 61010-1 Ed. 3 ; IEC 61010-1 Ed. 3 ; CENELEC EN 61010-1 ; CB Scheme
EMC Declaration	FCC 47CFR 15B Class A; IEC 61326-1 Ed.1	FCC 47CFR 15B Class A; IEC 61326-1 Ed.1

*Fan option is required if external operating ambient is expected to be > 35 ˚C.

Operating Humidity vs Temperature

Note: As temperature increases, maximum allowable humidity decreases.

Harvard Apparatus - PHD ULTRA NanoCool
Typical temperature curve

Ambient = 25°C

Temperature measured at center of syringe holder under 1ml BD syringe

SPECIFICATIONS

Setting Up The PHD ULTRA™ Nanomite

PHYSICAL VIEWS

The following diagrams show the important components of the PHD ULTRA™ Nanomite pump.
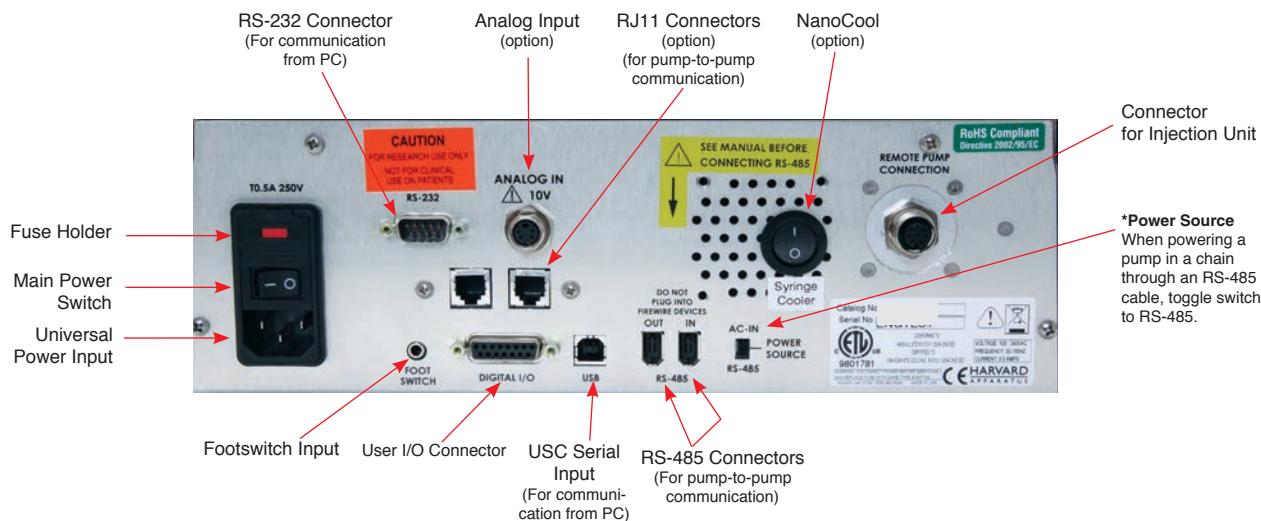
Rear view of the PHD ULTRA™ NanoCool pump showing important connections.

Front view of the PHD ULTRA™ Nanomite Control Box pump showing important components and controls.

## POWER CONNECTIONS AND PUMP STARTUP

⚠️ **CAUTION:** Do not connect to firewire devices. Damage may occur to pump or device.

The operating voltage range for the PHD ULTRA™ Nanomite is 100 - 240 VAC, 50-60 Hz. Use only the specified line cord for this product and make sure line cord is certified for country of use.

1. Plug the power cord into the Universal Power Input connector on the rear of the PHD ULTRA™ Nanomite control box.

2. Turn on main power switch located in the upper left corner of the rear panel.

3. The PHD ULTRA™ Nanomite touchscreen display will illuminate and display the startup screen while performing initial self-diagnostics. When complete, the unit will display either the Quick Start screen or the Method Main screen.
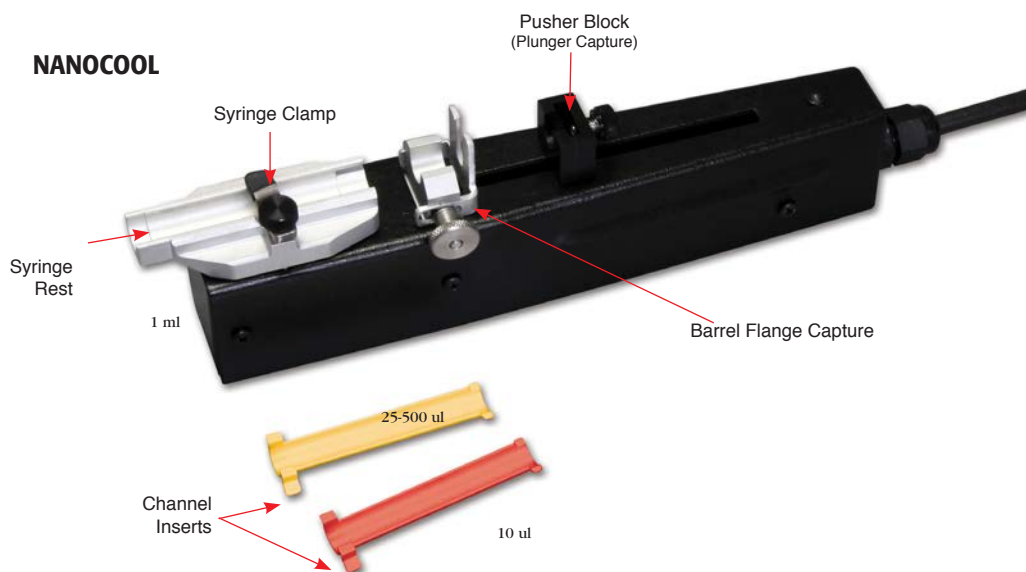
SYRINGE LOADING

NANOMITE
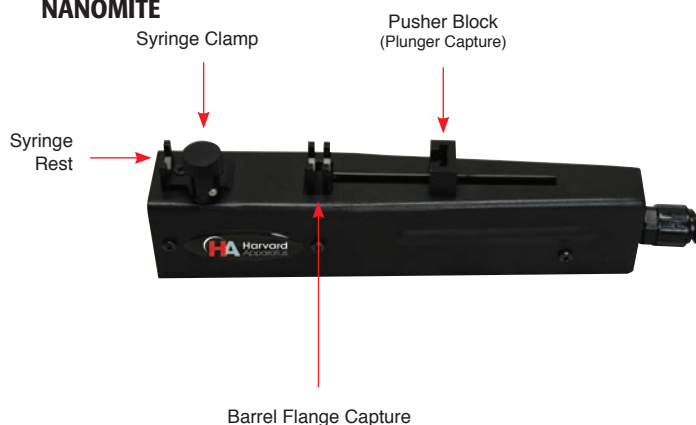
Nanomite Injector unit showing important controls for syringe loading

1. Raise the spring loaded syringe clamp and rotate to the side, away from the syringe rest.

2. On the control box, use the Fast Forward / Fast Reverse buttons to adjust the pusher block to the approximate length of the syringe.

3. Place the syringe on the syringe rest, ensuring that the barrel flange is positioned within its capture and plunger rests in the pusher block.

4. Lift and rotate the syringe clamp, placing it on the syringe barrel to secure the syringe in place.

NANOCOOL

NanoCool Injector unit showing important controls for syringe loading

1. Unscrew the thumbscrew on the syringe clamp and rotate to the side, away from the syringe rest.

2. On the control box, use the Fast Forward / Fast Reverse buttons to adjust the pusher block to the approximate length of the syringe.

3. Place the syringe on the syringe rest, ensuring that the barrel flange is positioned within its capture and plunger rests in the pusher block. Tighten thumbscrews to secure in place.

4. Rotate the syringe clamp, placing it on the syringe barrel and tighten the thumbscrew to secure the syringe in place.

NOTE: Channel inserts are provided for syringes smaller than 1 ml. Syringes 25-500 ul use the gold channel. 10 ul syringes use the red channel.

Appendices

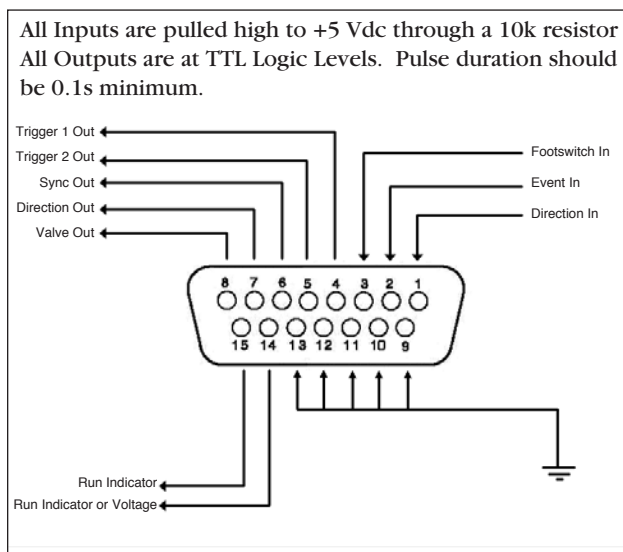### APPENDIX A: SYRINGE VOLUME/DIAMETER REFERENCE TABLE

Air–Tite HSW Norm-Ject		*Hamilton Glass - All Types*	
Size	Diameter	Size	Diameter
1 ml	4.69 mm	0.5 *µ*l	0.103 mm
		1	0.1457
Becton Dickinson 'Plasti-pak'		2	0.206
Size	Diameter	5	0.330*
1 ml	4.699 mm	5	0.343**
		10	0.485**
SGE Scientific Glass Engineering		10	0.461***
		25	0.729
Size	Diameter	50	1.03
5 *µ*l	0.343 mm	100	1.457
10	0.485	250	2.304
25	0.728	500	3.256
50	1.03	1 ml	4.608 mm
100	1.457		
250	2.303	** = Series 7000*	
500	3.257	*** = Series 700*	
1 ml	4.606 mm	**** = Series 1700*	
Terumo Japan		***Sherwood–Monoject Plastic***	
Size	Diameter	Size	Diameter
1 ml tb	4.7 mm	1 ml	4.674 mm
1 ml vc	6.5		

APPENDIX B: MIN/MAX FLOW RATE

Nominal Minimum/Maximum Flow Rates for Various Syringes. (Actual Limits will vary depending on syringe manufacturer)					
Syringe Size	**Syringe ID**	**Minimum Rate**	**Units**	**Maximum Rate**	**Units**
0.5 μl	0.103 mm	3.66000	pl/min	1.90879	μl/min
1 μl	0.1457 mm	7.32000	pl/min	3.81946	μl/min
2 μl	0.206 mm	14.7000	pl/min	7.63515	μl/min
5 μl	0.343 mm	40.7400	pl/min	21.1676	μl/min
10 μl	0.485 mm	81.4800	pl/min	42.3220	μl/min
25 μl	0.729 mm	184.140	pl/min	95.6177	μl/min
50 μl	1.030 mm	367.560	pl/min	190.879	μl/min
100 μl	1.457 mm	735.600	pl/min	381.946	μl/min
250 μl	2.304 mm	1.83942	nl/min	955.098	μl/min
500 μl	3.256 mm	3.67356	nl/min	1.90744	ml/min
1000 μl	4.608 mm	7.35774	nl/min	3.82039	ml/min

APPENDIX C: EXTERNAL CONNECTIONS

User I/O Connector Specifications

All Inputs are pulled high to +5 Vdc through a 10k resistor
All Outputs are at TTL Logic Levels. Pulse duration should
be 0.1s minimum.

Trigger 1 Out
Trigger 2 Out
Sync Out
Direction Out
Valve Out

Footswitch In
Event In
Direction In

8 7 6 5 4 3 2 1
15 14 13 12 11 10 9

Run Indicator
Run Indicator or Voltage

Pin Assignments:

1. **Direction control input**
   Rising edge sets pump to infuse
   Falling edge sets pump to refill

2. **Trigger Input**
   Event trigger – falling edge triggers a
   program event

3. **Footswitch Input (or Timer)**
   Settable to work as:

   - Momentary switch closure to ground
   or TTL Logic Low; falling edge toggles
   between states (run/stop)

   -Starts on rising edge, stops on falling edge

   -Starts on falling edge, stops on rising edge

4. **Trigger 1 Output**
   TTL Logic Output-Default = Low Control
   thru method or serial comm

5. **Trigger 2 Output**
   TTL Logic Output-Default = Low Control
   thru method or serial comm

6. **Sync Output**
   TTL Logic Output –
   Rising Edge = Start Infuse
   Falling Edge= Start Refill

7. **Direction Output**
   TTL Logic Output –
   High = Refill
   Low = Infuse

8. **Valve Output** (controls voltage only)
   TTL Logic Output –
   High = Valve Actuated
   Low = Valve Off

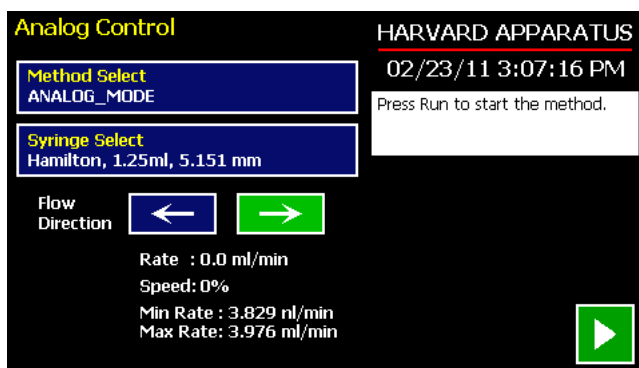> **NOTE:** Valve follows direction change.

9-13. **Signal Return / Ground**

14. **Run Indicator Voltage**
    +5V through a 470 ohm resistor (connect
    to LED Anode)

15. **Run Indicator Output**
    TTL Logic Output, active low (low = run)
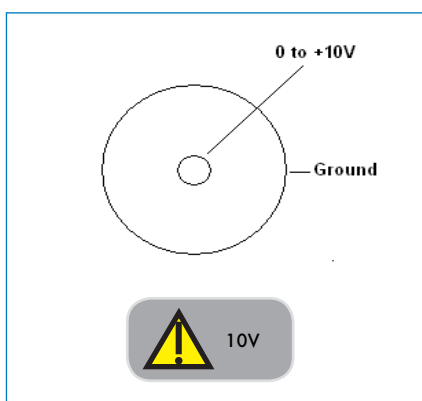   (connect to LED Cathode)

Electrical Specifications:

Inputs:	$V_{IH} \geq 2V$	$I_{IH} \leq 20\mu A$
	$V_{IL} \leq 0.4V$	$I_{IL} \leq 0.5mA$

Outputs:	$V_{OH} \geq 3.8V$	$I_{OH} \leq 6mA$
	$V_{OL} \leq 0.4V$	$I_{OL} \leq 6mA$

Analog Input Option

Analog Control Screen

BNC Connector

> **NOTE:** Voltage must be set to 0 VDC when pump is turned on.
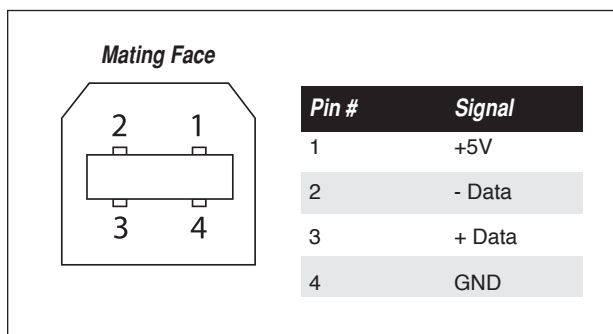
> **NOTE:** Although the Analog Mode cycle time is 100 ms, when changing from min to max (or max to min) rates please allow a minimum of 250 ms.

> **NOTE:** Although the Analog Mode cycle time is 100 ms, when changing from min to max (or max to min) rates please allow a minimum of 250 ms.
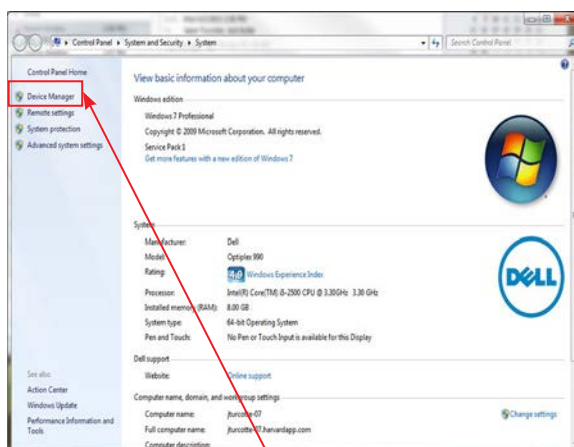
USB

Pin #	Signal
1	+5V
2	- Data
3	+ Data
4	GND

USB Type B Female.

USB VIRTUAL COMMPORT DRIVER INSTALLATION

When you connect the PHD ULTRA™ Nanomite pump to a computer via USB, Windows will seek to install a driver for communication. The following section details the installation of the Virtual CommPort Driver supplied with the PHD ULTRA™ Nanomite pump.

1. Connect the pump to the computer via USB. Open the control panel and select System and Security and then System. Click Device Manager on the left hand menu.
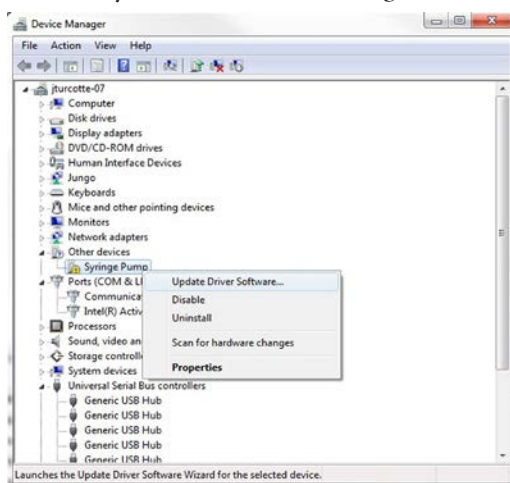

2. Two Flash Update Applications will be displayed in the device manager, under Other Devices. Right click on either of the flash update applications and select Update Driver Software.
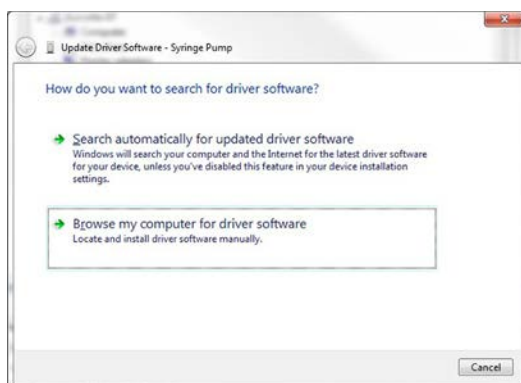
3. Select Browse my computer for driver software.

4. Click Browse and navigate to the pump drivers folder located on the CD supplied with the pump. Select the file Harvard Apparatus USB-CDC.inf. Make sure the Include Subfolders box is checked and then click next.
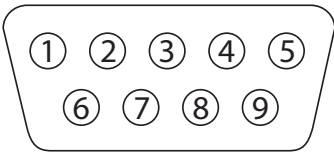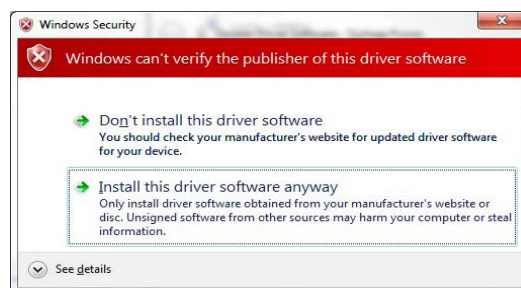

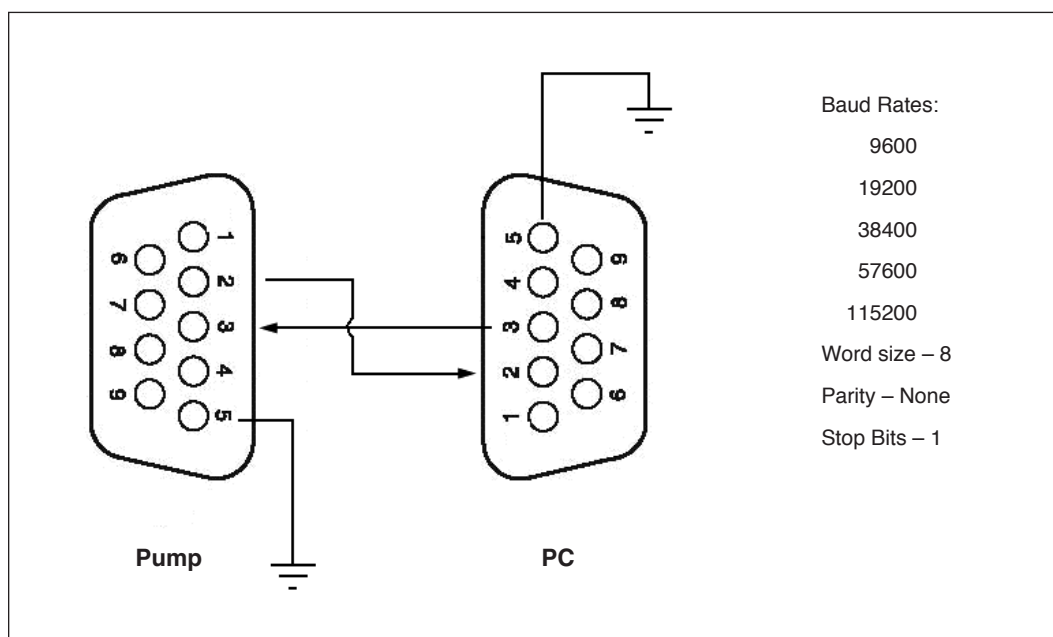5. If a warning message regarding the driver publisher is displayed, choose Install this driver software anyway.
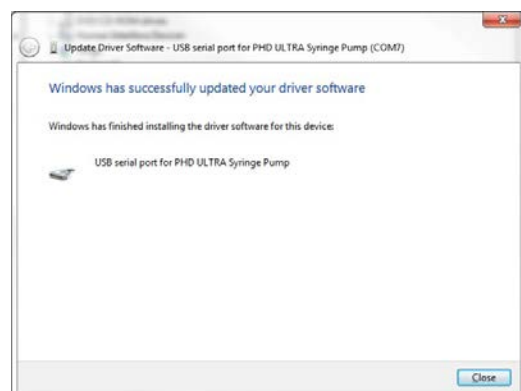
6. Click Close after the software has been successfully installed.
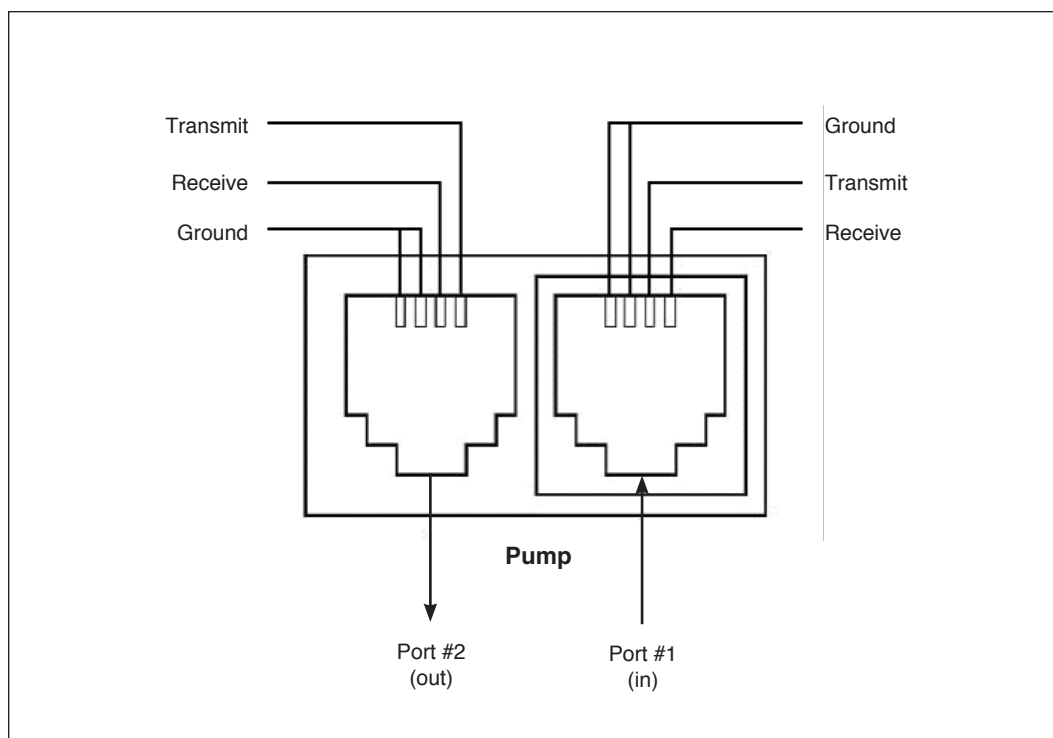
RS-232 Specifications

Pin #	Signal
2	TXD
3	RXD
5	GND
1, 4, 6-9	N/C

RS-232 9-Pin D-Sub Male

Baud Rates:

9600

19200

38400

57600

115200

Word size – 8

Parity – None

Stop Bits – 1
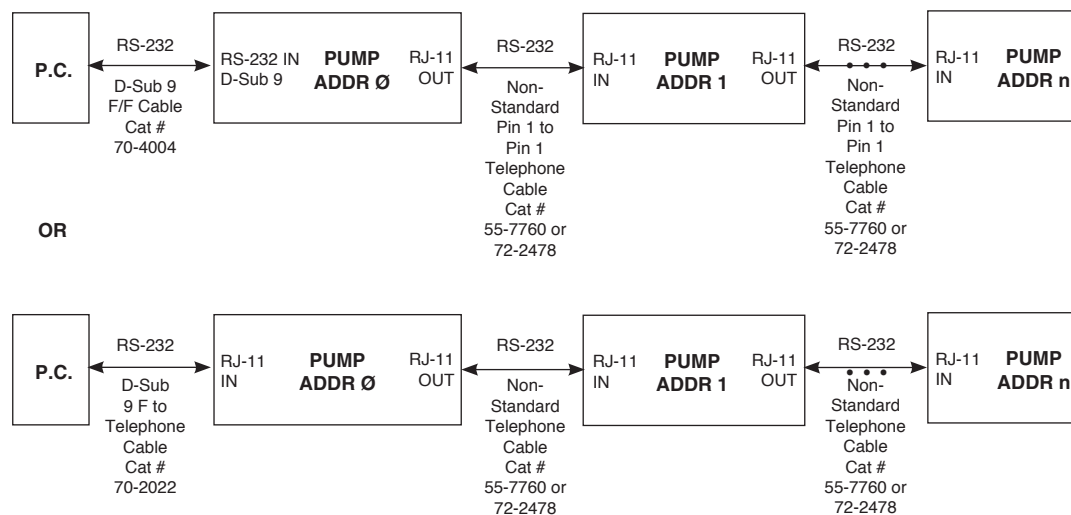
Pump   **PC**

RS-232 Specifications

Legacy RJ-11 Option

Pumps with Legacy RJ-11 Option.

OR

Daisy-Chaining with Legacy RJ-11 Option.

NOTE: Pumps 1...n also have RJ-11 telephone jacks.

NOTE: When daisy-chaining with RS-232, each pump must be self-powered. If a pump in the RS-232 daisy-chain is powered down, all pumps "down-stream" from it will lose communications.
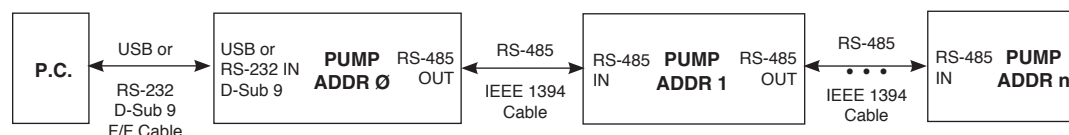
PUMP-TO-PUMP CONNECTION RS-485

⚠️ **CAUTION:** Do not connect to firewire ports on a PC. Damage may ocur to pump and/or PC.

RS-485 In/Out

Pin #	RS-485 In Signal	RS-485 Out Signal	Notes
1	PWR IN	PWR OUT (+30V)*	* Protected by resettable fuse
2	GND	GND	
3	RS-485 A	TIED TO PIN 4**	**100 Ω, ½ w to GND termination
4	RS-485 B	TIED TO PIN 3**	
5	TIED TO PIN 6**	RS-485 A	
6	TIED TO PIN 5**	RS-485 B	

Mating Face

```
 1   2
 3   4
 5   6
```

- IEEE-1394 Sockets

| P.C. | USB or
RS-232
D-Sub 9
F/F Cable | USB or
RS-232 IN
D-Sub 9 | **PUMP
ADDR Ø** | RS-485
OUT | RS-485
IEEE 1394
Cable | RS-485
IN | **PUMP
ADDR 1** | RS-485
OUT | RS-485
• • •
IEEE 1394
Cable | RS-485
IN | **PUMP
ADDR n** |

Daisy chaining via RS-485.

RS–485 Dasiy Chain Connection Options:

- If all pumps have software versions 2.0.0 or higher, 99 pumps in chain.

- If all pumps have software versions 1.3.7 or lower, 99 pumps in chain.

- If mix of pumps with software version 1.3.7 or lower and 2.0.0 or higher, maximum of 5 pumps in chain and **1** RS-485 adapter (catalog # 70-4025) required.

✏️ **NOTE:** When daisy-chaining with RS-485, at minimum, every fourth pump must be self powered (i.e., another stand-alone unit). This can be affected by Force Selection.

✏️ **NOTE:** When applying power to pumps in a daisy-chain, apply power to the last group and work backwards.

✏️ **NOTE:** When removing power, be sure to remember that power removed from a stand-alone unit will also cause power to be removed from all RS-485 powered units deriving power from it.

✏️ **NOTE:** Power may be removed from any group of pumps, except the first group, without affecting communications "down-stream'.

✏️ **NOTE:** If a chain of pumps with mixed software is desired, pumps with software versions 1.3.7 or lower can be returned to manufacturer for a hardware update.

Gradient Systems

Gradient systems consist of up to two pumps attached to a master pump via RS-485 cables. Gradient systems with two pumps attached through an RS-485 cable will have two buttons displayed, one for each pump.
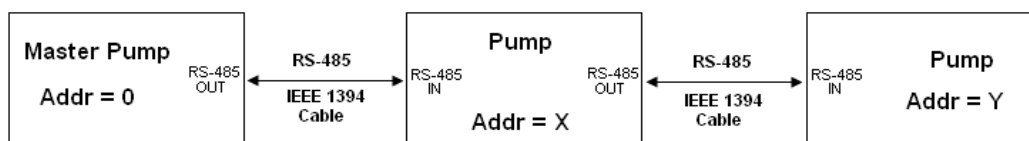
Gradient System
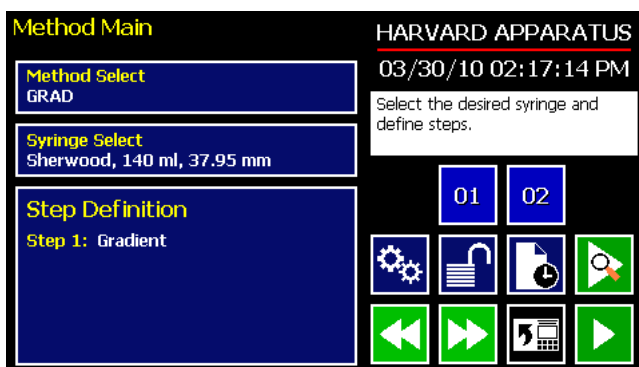
Method Main screen showing a Gradient system with 2 active pumps, addressed '01' and '02'

The pump control button's background color indicates the status of the remote unit.

- Blue Background   = Connected / Motor Stopped
- Red Background   = Comm Error
- Yellow Background = Motor Stall
- Green Background = Motor Running

NOTE: For gradient systems, the Remote Address in the Settings menu must also be set to 0.

APPENDIX D: MAINTENANCE

Maintenance

PHD ULTRA™ Nanomite series pumps require no special maintenance other than keeping them clean by avoiding accidental spills of pumped material. Refer to the chemical compatibility chart below for specific chemical resistance information.

To clean the exterior surfaces, use a lint-free cloth to remove loose dust. Use care to avoid scratching the clear display window. For more efficient cleaning, use a soft cloth dampened [not soaked] with water, an aqueous solution of 75% isopropyl alcohol, or a mild detergent.

Chemical Compatibility Chart

Chemical	Concentration	Overlay Cover	Overlay Adhesive	Chassis (control box)
Acetonitrile	99.5%	A	A	A
Methyl alcohol	99.8%	A	-	A
Hydrochloric Acid	36.5%	A	A	A
Bleach	100%	A	A	A
Windex®	100%	A	A	A
Isopropyl Alcohol	99.5%	A	D	A
Dish Soap	–	A	A	A
Motor Oil	100%	A	A	A
Simple Green	100%	A	A	A
Gasoline	100%	A	D	C
Ethylene Glycol (Antifreeze)	100%	A	A	A
Mineral Oil	100%	A	A	A
Ammonia	27%	A	A	A
Magnalube	100%	A	A	A
Superlube	100%	A	A	A
Acetone	99.5%	A	D	D
Soda (Coca-Cola)®	100%	A	A	A
Sulfuric Acid	95%	D	D	A
Dimethyl Sulfoxide	99.9%	A	C	A
Sodium Hydroxide	50%	A	A	A
Nitric Acid	68%	D	D	C
Chloroform	100%	D	D	D

The chemical resistance data provided is for reference only. The data is based on the manufacturer's recommendations and is not a guarantee of chemical compatibility for your test conditions. Wipe any spills immediately.

A Satisfatory	D Severe Effects
B Fair, Minor Effects	– not tested
C Poor, Moderate Effects	

Fuse Replacement
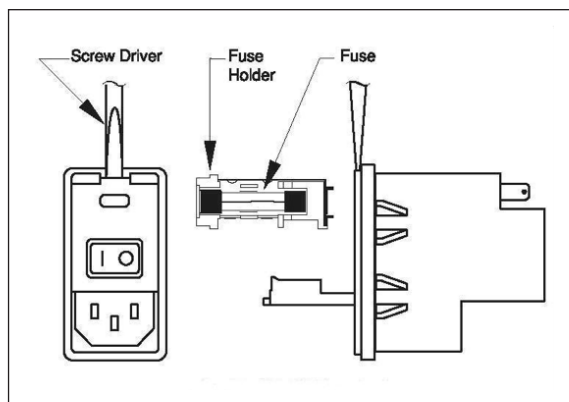
Key Information

1. Make sure the power cord is disconnected from the main supply before servicing the fuse.

2. Use only Type 3AG, 1/4" x 11/4, ½ amp, 250 volt; Type T (time delay) fuses (Harvard Apparatus Part No. 5146-037 or equivalent).

Turn off power and remove power cord from power module. Use a straight blade screwdriver to pry open the access door. Remove the fuse holder and then remove the fuses from this holder as shown in figure below. Replace fuses, and then replace the fuse holder.

Battery Replacement

1. Remove screw and swing cover to the side.

2. Slide battery out from under clip.

3. Install Lithium Coin Battery: 3V, 16mm CR1620 (Harvard Part No. 5155-288 or equivalent) by sliding under clip with positive side facing out

⚠️ **CAUTION:** Use only same type & rated battery. Observe polarity when installing.

Troubleshooting

Infusion Accuracy

To ensure infusion accuracy always use a new syringe and measure syringe bore diameter and enter actual dimensions in millimeters (mm) using the Custom Syringe entry option. Additionally, make sure that the guide rods and lead screw are properly lubricated.

RS-232 Difficulties

Verify that the baud rates, data framing parameters, data bits, parity, and stop bits on all devices are the same. Verify flow control (handshaking) is set to None. If an address is set to other than address Ø, make sure commands and queries are prefixed with the address. Make sure straight-through pinning is used for the cables; do not use null-modem cables.

Erase/Clear Disc:

There may be an instance where you want to delete all of your custom methods from the pump. There may also be instances where you may need to delete/clear the disc in order to power up the pump. To do so:

*   Turn the pump on.

*   When the start-up screen appears, press the 4 corners of the display in a clockwise order starting at the top left. After each corner is correctly pressed, it will turn dark gray.

*   Press yes to confirm or wait 5 seconds to allow the pump to start normally without clearing the disc.

*   There is a 5 second time limit for each press of the screen. If the time limit expires, the pump will start normally without clearing the disc.
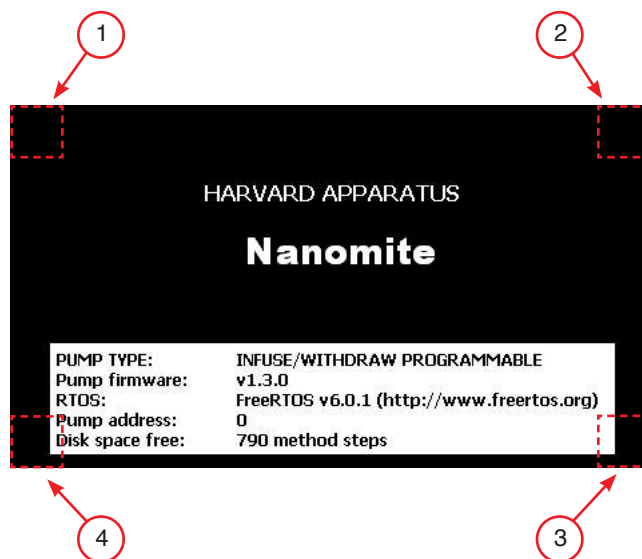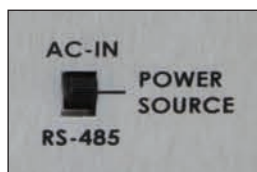

Press the 4 corners of the start-up screen display in a clockwise order to delete/ clear the disc .

NOTE: It is recommended that you save your methods periodically by uploading them to a PC.

Unit won't power-up

Verify that the Power Source Switch on the rear of the pump is set to AC-IN if powering through linecord or RS-485 if powering in a chain.

Upgrading EZ PRO™ Software

1. Upload the latest software version to your desktop (format is *filename.srec*).

2. Disconnect all I/O devices and then connect the pump to PC using a USB cable.

3. Press settings button then press Upgrade Software button twice to enter "Boot Loader Mode"..

> **NOTE:** To exit bootloader mode without upgrading the software, power cycle the pump.

> **NOTE:** Prior to upgrading, users will need to install the PHD ULTRA™ USB driver as well as the bootloader driver file (PHDUltra-Bootloader.inf). Reference "USB Virtual Comport Driver Installation".

4. From the CD provided with the pump, open the ULTRA Nanomite series Pump Updater Application.
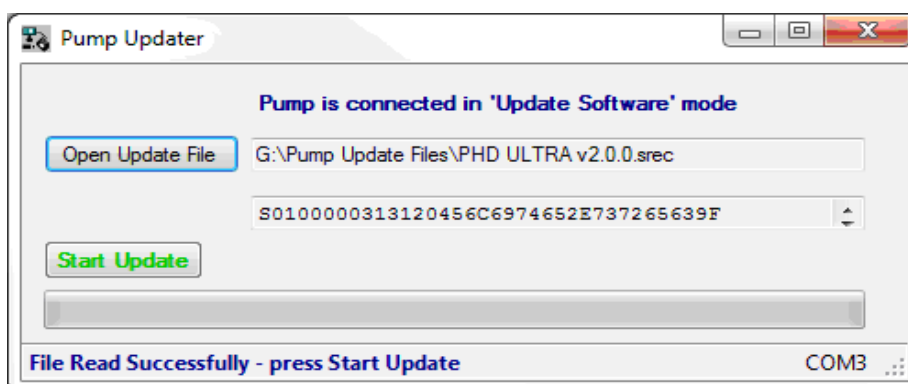
5. Click Open Update File and browse the file previously saved on your desktop and click Open.

6. Click Start Update
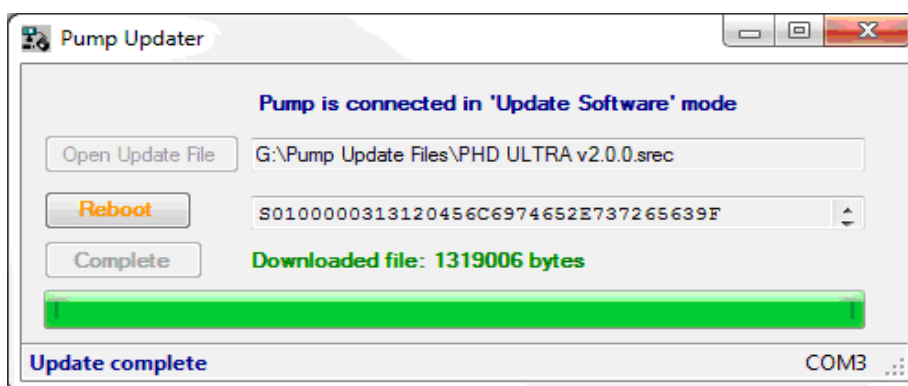
7. After the update is complete, press Reboot to power Cycle the pump.

PHD ULTRA™ Nanomite Display Error Messages

Out of Range

A value was entered or encountered in a pump program that was beyond the pump's limits.

Power Failure Notification

If power to the pump is interrupted during operation, an alarm will sound to alert the user to the interruption. When power is restored, an onscreen message is displayed to indicate the interruption.
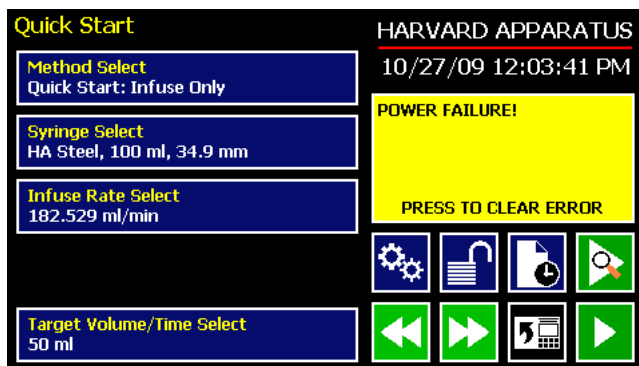
The PHD ULTRA™ Nanomite Pump will notify you of a power failure with a message when power is restored.

Low Battery Indication

Time/Date area will turn red when battery is low.
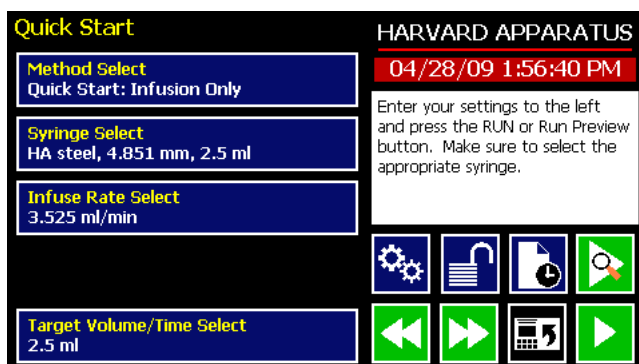
The Time/Date area turns red when the battery is low.

APPENDIX E: ORDERING INFORMATION

Standard Version

Description	Stand Alone System	Remote System	Satellite	Syringe Pump Module
PHD ULTRA™ Nanomite Infusion/Withdrawal Programmable	N/A	**70-3601**	N/A	N/A
PHD ULTRA™ NanoCool™ Infusion/Withdrawal Programmable	N/A	**88-1050**	N/A	N/A

Options

Catalog #	Description
70-3030	PHD ULTRA™ Nanomite RS-232 RJ-11 Connectors Option
70-3041	PHD ULTRA™ Nanomite Analog Control Input Option (0-10v)

Accessories

Catalog #	Description
70-4000	RS-485 Cable for Pump-to-Pump Communication, 0.5 m
70-4021	RS-485 Cable for Pump-to-Pump Communication, 1 m
70-4001	RS-485 Cable for Pump-to-Pump Communication, 2 m
70-4020	RS-485 Cable for Pump-to-Pump Communication, 30 ft
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
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
5113-001	Line Cord, US (115 v)
70-3039	Cable for Analog Control Option
70-4005	Adapter, PHD Digital I/O
70-4006	Adapter, D-sub 15 to Term. Blk
70-2215	Footswitch (w/ Phono Plug)
5012-005	Hex Key, 3/32
70-4013	Lubricant, SuperLube, 1cc
70-4025	RS-485 Adapter (See Appendix C: External Controls)

For additional items such as Syringe Heaters, Spill Sensors, Temperature Controllers, Nano-Fluidic Accessories, and much more please visit our website www.harvardapparatus.com or call (800) 272-2775.

Declaration of Conformity

Manufacturer: **Harvard Apparatus, Inc.**
84 October Hill Road
Holliston, Massachusetts 01746-1388, U.S.A.
Phone: (508) 893-8999

We herewith declare that the following product:

Product Name: **PHD ULTRA™ Series Syringe Pump**
Model: **PHD ULTRA™ Nanomite & NanoCool**

To which this declaration relates, is in conformity with the applicable EC Directives, harmonized standards, and other normative requirements:

Application of
Council Directive(s): **2006/95/EC** **Low Voltage Directive**
2004/108/EC **Electromagnetic Compatibility Directive**
2011/65/EU **RoHS Directive**

Standard(s) to which
conformity is declared:

  Safety: **EN 61010-1:2012 (3rd Edition)**

  Emmissions/Immunity: **IEC 61326-1:2005, Ed. 1**
IEC 61000-4-2:2001
IEC 61000-4-3:2002
IEC 61000-4-4:2004
IEC 61000-4-5:2001
IEC 61000-4-6:2003
IEC 61000-4-8:1993
IEC 61000-4-11:2004
IEC 61000-3-2:2000
IEC 61000-3-3:2002
CISPR11:2003+A1:2004, Group 1, Class A

EMC and Safety compliance were evaluated by Intertek/ETL Semko

Reference test report
file numbers: **3177745 BOX-001, -003, -004, -005A, -006A, -007B,**
10062834 BOX-004, -004A

I, the undersigned, hereby declare that the equipment specified above conforms to the above Directive(s) and Standard(s).

Place: **United States of America**
Date: **April 02, 2012**

$C \epsilon$

_____
(Signature)

_____
Beth Bauman
(Full Name)

_____
VP Engineering / Operations
(Position)