Шприцевые насосы

Описание

По вопросам продаж и поддержки обращайтесь:

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Satellite Infuse/Withdraw PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ Satellite Pumps are infusion/withdrawal pumps. They are available in three configurations: standard, push/pull and high force (PHD ULTRA™ 4400 Satellite). The Satellite Pumps are combined with stand alone PHD ULTRA™ Pumps to create a Gradient System. Satellite Pumps can only be powered from a stand alone PHD ULTRA™ via RS-485. They cannot be controlled with a PC (Please see our PHD ULTRA OEM pumps for PC controlled modules). Satellite Pumps include a footswitch input, USB and RS-485 connectors.

Item No.	Description
70-3406	PHD ULTRA™ Satellite Syringe Pump Infuse/Withdraw
70-3408	PHD ULTRA™ Satellite Syringe Pump Infuse/Withdraw with Push/Pull Mechanism
70-3410	PHD ULTRA™ 4400 Satellite Syringe Pump Infuse/Withdraw

DETAILS

The PHD ULTRA™ Satellite Pumps are infusion/withdrawal pumps. They are available in three configurations: standard, push/pull and high force (PHD ULTRA™ 4400 Satellite). The Satellite Pumps are combined with stand alone PHD ULTRA™ Pumps to create a Gradient System. Satellite Pumps can only be powered from a stand alone PHD ULTRA™ via RSâ€485. They cannot be controlled with a PC (Please see our PHD ULTRA OEM pumps for PC controlled modules). Satellite Pumps include a footswitch input, USB and RSâ€485 connectors.

SPECIFICATIONS

Specifications	70-3406	70-3408	70-3410
Accuracy	±0.25%	±0.25%	±0.35%
Classification	Class I	Class I	Class I
Dimensions L x D x H	11.75 x 5.5 x 6.5 in (29.8 x 14.0 x 16.5 cm)		

Specifications	70-3406	70-3408	70-3410
Display	N/A	N/A	N/A
Drive Motor	1.8° Stepper Motor	1.8° Stepper Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	215.8 ml/min using a 140 ml syringe	215.8 ml/min using a 140 ml syringe	215.8 ml/min using a 140 ml syringe
Flow Rate Minimum	3.06 pl/min using a 0.5 µl syringe	3.06 pl/min using a 0.5 µl syringe	3.06 pl/min using a 0.5 µl syringe
I/O TTL Connectors	15-pin D-sub Connector	15-pin D-sub Connector	15-pin D-sub Connector
Input Power	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse
Installation Category	Continuous	Continuous	Continuous
Max Linear Force	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	200 lb @ 100% Force Selection
Mode of Operation	-10°C to 70°C	-10°C to 70°C	-10°C to 70°C
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	11.7 lb (5.3 kg)	11.7 lb (5.3 kg)	11.7 lb (5.3 kg)
No of Syringes	2	4	1
Non Volatile Memory	Storage of all settings	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800	12,800	6,400
Pollution Degree	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Pump Configuration	Satellite	Satellite	Satellite
Pump Function	Infuse/Withdraw	Push/Pull	Infuse/Withdraw
Pusher Travel Rate Maximum	190.8 mm/min	190.8 mm/min	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min	0.36 µm/min

Specifications	70-3406	70-3408	70-3410
RS-232 Connectors	N/A	N/A	N/A
Rack Type	Standard	Push/Pull	Standard
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Syringe Size Maximum	140 ml	140 ml	140 ml
Syringe Size Minimum	0.5 µl	0.5 µl	0.5 µl
USB Connectors	Type B	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Standard Infusion Only Pump 11 Elite Syringe Pumps

The Pump 11 Elite Series of syringe pumps expands its capabilities to satisfy your experimental requirements. These compact syringe pumps carry on the tradition as the premiere workhorse infusion pump, offering unparalleled ease of use with a high resolution touch screen with intuitive icon interface.

These innovative syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 ul to 60 ml (single syringe) and 0.5 ul to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Infusion Only Models are available in single or dual syringe rack configurations. These pumps have advanced connectivity with a USB serial port for computer control and footswitch connection for stop/start control (footswitch sold separately).

Item No.	Description
70-4500	Pump 11 Elite Infusion Only Single Syringe
70-4501	Pump 11 Elite Infusion Only Dual Syringe

DETAILS

The Pump 11 Elite Series is a family of accurate, low flow syringe pumps designed for use in applications including: mass spec calibration, drug and nutritional studies, reactor dosing, and electro-spinning.

These innovative syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 60 ml (single syringe) and 0.5 µl to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Infusion Only Models are available in single or dual syringe rack configurations. These pumps have advanced connectivity with a USB serial port for computer control and footswitch connection for stop/start control (footswitch sold separately). The infusion Only (single and dual syringe models) support infusion operations at user-defined flow rates and with selectable target volume or time values to control the total infusion volume. The Infusion Only models do not include programmable, user-defined methods. (Infusion/Withdrawal Programmable models are also available)

Easy-to-Use Interface

The Pump 11 Elite color LCD touch screen with graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Quick Start infusion screen is the primary "home" for the pumps. From that screen you can access all the commands needed to operate the Pump 11 Elite, as well as access the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

You can control operations directly with the touch screen or remotely from an independent computer or device via the external footswitch interface.

Accessories

A full range of accessories are compatible with the Pump 11 Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4500**	**70-4501**
Accuracy	±0.5%	±0.5%
Classification	Class I	Class I
Dimensions Control Box	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	88.28 ml/min using 60 ml syringe	31.97 ml/min using 10 ml syringe
Flow Rate Minimum	1.28 pl/min using 0.5 µl syringe	1.28 pl/min using 0.5 µl syringe
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector

Specifications	70-4500	70-4501
Input Power	12-30 VDC	12-30 VDC
Installation Category	II	II
Max Linear Force	35 lb @ 100% Force Selection	35 lb @ 100% Force Selection
Mode of Operation	Continuous	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	4.6 lb (2.1 kg)	4.6 lb (2.1 kg)
No of Syringes	1	2
Non Volatile Memory	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	15,360	15,360
Pollution Degree	1	1
Pump Configuration	Standard	Standard
Pump Function	Infusion Only	Infusion Only
Pusher Travel Rate Maximum	159.8 mm/min	159.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min
RS 232 Connectors	optional RJ-11	optional RJ-11
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep
Syringe Size Maximum	60 ml	10 ml
Syringe Size Minimum	0.5 µl	0.5 µl
USB Connectors	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Standard Infuse/Withdraw Pump 11 Pico Plus Elite Programmable Syringe Pump

The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite is the lowest flow, highest accuracy pump with unparalleled ease of use with a high resolution touch screen with intuitive icon interface. It can deliver volumes down to 0.54 pl/min. This infusion/withdrawal dual syringe pump is ideal for applications such as microdialysis. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

This syringe pump has a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 10 ml (dual channel version) or 0.5 µl to 60 ml (single channel version). The Pump 11 Pico Plus Elite offers enhanced flow performance with high accuracy and smooth flow from 0.54 pl/min to 11.70 ml/min (dual channel version) or 0.54 pl/min to 39.77 ml (single channel version).

The Pump 11 Pico Plus Elite is an Infusion/Withdrawal Programmable Syringe Pump available in single or dual syringe configurations. This pump has advanced connectivity with a footswitch, USB serial port for computer control, RS-485 (or optional RJ-II) ports for daisy chaining pumps and Digital I/O for remote control.

Item No.	Description
70-4506	Pump 11 Pico Plus Elite Infusion/Withdrawal Programmable Dual Syringe Pump
70-4511	Pump 11 Pico Plus Elite Infusion/Withdrawal Programmable Single Syringe

DETAILS

The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite is the lowest flow, highest accuracy pump with unparalleled ease of use with a high resolution touch screen with intuitive icon interface. It can deliver volumes down to 0.54 pl/min. This infusion/withdrawal dual syringe pump is ideal for applications such as microdialysis. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

Features

- New color LCD touch screen
- Intuitive icon interface
- Up-front control knobs for ease of operation
- Quick start methods
- Program simple to complex methods without a PC
- Relative time clock

- Vertical or horizontal orientation
- 35 lb linear force adjustable across the entire flow range
- Can daisy chain pumps
- CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Microfluidics
- Microdialysis
- Accurate delivery of coatings
- Reactor dosing
- Cell injections
- Fluid sampling
- High presure injection
- Low pressure chromatography
- Flow programming
- Binary gradients
- % composition step changes
- I/O interactive experiments

This syringe pump has a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5ul to 10 ml (dual channel version) or 0.5 ul to 60 ml (single channel version). The Pump 11 Pico Plus Elite offers enhanced flow performance with high accuracy and smooth flow from 0.54 pl/min to 11.70 ml/min (dual channel version) or 0.54 pl/min to 39.77 ml (single channel version).

The Pump 11 Pico Plus Elite is an Infusion/Withdrawal Programmable Syringe Pump available in single or dual syringe configurations. This pump has advanced connectivity with a footswitch, USB serial port for computer control, RS-485 (or optional RJ-11) ports for daisy chaining pumps and Digital I/O for remote control.

Since 1901 Harvard Apparatus has been supporting bioresearch fluidics requirements with the culmination being the introduction of the first commercial syringe pump for bioresearch in 1956. Since 1956, over 70,000 satisfied syringe pump users around the world have made Harvard Apparatus syringe pumps the worlds #1 choice.

The Pump 11 Pico Plus Elite is a low flow syringe pump designed for use in applications including: microdialysis, microfluidics, cellular injections and fluid sampling.

Program Description

To operate the Pump 11 Pico Plus Elite, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method.

Advanced Programming Features

- Constant Rate
- Ramp
- Gradients
- % composition (up to two solvents)
- Autofill
- I/O — dedicated and user defined I/O

Easy-to-Use Interface

The Pump 11 Pico Plus Elite color LCD touch screen graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary set up screens for the applications. From those screens you can access all the commands needed to operate the Pump 11 Elite, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main navigational branches, the quick start Methods, user-defined

Methods, and system settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface. Advanced GLP Documentation Features:

- Download experimental parameter information to PC
- Alpha/numeric keypad for method naming

Accessories

A full range of accessories are compatible with the Pump 11 Pico Plus Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4506**	**70-4511**
Pump Configuration	Standard	Standard
Pump Function	Infusion/Withdrawal/Programmable	Infusion/Withdrawal/Programmable
Flow Rate Maximum	11.70 ml/min using 10 ml syringe	39.77 ml/min using 60 ml syringe
Flow Rate Minimum	0.54 pl/min using 0.5 Âµl syringe	0.54 pl/min using 0.5 Âµl syringe
Syringe Size Minimum	0.5 Âµl	0.5 Âµl
Syringe Size Maximum	10 ml	60 ml
Max Linear Force	35 lb @ 100% Force Selection	35 lb @ 100% Force Selection
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector
RS 232 Connectors	optional RJ-11	optional RJ-11
USB Connectors	Type B	Type B
Accuracy	Â±0.35%	Â±0.35%
Non Volatile Memory	Storage of all settings	Storage of all settings
Drive Motor	0.9Â° Stepper Motor	0.9Â° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping

Specifications	70-4506	70-4511
Number of Microsteps per one rev of Lead Screw	20,480	20,480
Step Rate Minimum	27.5 sec/Âµstep	27.5 sec/Âµstep
Step Rate Maximum	26 Âµsec/Âµstep	26 Âµsec/Âµstep
Step Resolution	0.031 Âµm/Âµstep	0.031 Âµm/Âµstep
Pusher Travel Rate Minimum	0.068 Âµm/min	0.068 Âµm/min
Pusher Travel Rate Maximum	71.55 mm/min	71.55 mm/min
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Input Power	12-30 VDC	12-30 VDC
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz
Dimensions, Control Box L x D x H	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Net Weight	4.6 In (2.1 kg)	
Environmental Operating Temperature	40Â°F to 104Â°F (4Â°C to 40Â°C)	40Â°F to 104Â°F (Â°C to 40Â°C)
Environmental Storage Temperature	14Â°F to 158Â°F (-10Â°C to 70Â°C)	14Â°F to 158Â°F (-10Â°C to 70Â°C)
Environmental 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
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS

Standard Infuse/Withdraw PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. Integrated EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks
- Connectivity: RS-232 and USB for PC; RS-485 for pump to pump daisy chain

Item No.	Description
70-3007	PHD ULTRA™ Syringe Pump Infuse/Withdraw Programmable
70-3009	PHD ULTRA™ Syringe Pump with Push/Pull Mechanism Programmable
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump

Item No.	Description
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks

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Features

- Superior drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- Color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range
- Daisy chain
- Remote configuration available
- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme

- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning
- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method.
2. Enter operating parameters.
3. Preview your method
4. Run your method.

Advanced Programming Features

- **Flow Programming**—change the flow with time, volume or a triggered event as many times as you like

- **Bolus**—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- **Concentration Delivery**—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- **Gradients**
- **% ratio—**up to three solvents
- **I/O** — dedicated and user defined I/O
- **Pulsed Flow**—so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140 ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- **Animal Infusions or Withdrawals**—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- **Proportioning and Delivering of Mixtures**—mixing gradients or proportions with independent control of two liquids.
- **Aerosol for Coating**—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- **Delivery to Mass Spectroscopy**—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- **Compensating Flows**—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- **Dispensers/Injectors**—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

The PHD ULTRA™ Syringe Pump is available in three configurations designed for different operating environments and varying degrees of operational flexibility.

1. Infuse Only: This model supports infusion operations at user-definable flow rates and with selectable target volume or time values to control the total infusion volume. The entry-level Infuse Only model does not include programmable, user-defined methods.

2. Infuse/Withdraw: This model supports infusion and withdraw operations at user-definable flow rates and with selectable target volumes or time values to control the total volume pumped for both the infusion and withdraw portions of a procedure. This model provides access to many of the advanced method programming options of the PHD ULTRA™, but only supports a single stored method.

3. Infuse/Withdraw Programmable: This model supports both infusion and withdraw operations and can use both simplified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the PHD ULTRA™, this model also allows users to create and store multiple user-defined methods on the pump.

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

SPECIFICATIONS

Specifications	70-3006	70-3007	70-3008	70-3009
Accuracy	±0.25%	±0.25%	±0.25%	±0.25%
Classification	Class I			
Dimensions, Control Box L xD x H	12.0 x 8.5 x 7.25 in (30.48 x 21.59 x 18.42 c,)			
Display	4.3" WQVGA TFT Color Display with Touchpad			
Drive Motor	0.9° Stepper Motor			
Environmental Humidity	20% to 80% RH, non condensing			
Environmental Operating Temperature	40°F to 104°F* (4°C to 40°C*)			
Environmental Storage Temperature	14°F to 158°F(-10°C to 70°C)			
Flow Rate Maximum	216 ml/min using 140 ml syringe			
Flow Rate Minimum	1.56 pl/min using 0.5 µl syringe			
I/O & TTL Connectors	15 pin D-Sub Connector			
Input Power	50 W, 0.5 A fuse			
Installation Category	II			
Max Linear Force	75 lb @ 100% Force Selection			
Mode of Operation	Continuous			
Motor Drive Control	Microprocessor with 1/16 microstepping			
Net Weight	10 lb (4.5 kg)			

Specifications	70-3006	70-3007	70-3008	70-3009
No of Syringes	2			
Non Volatile Memory	Storage of all settings			
Number of Microsteps per one rev of Lead Screw	12,800			
Pollution Degree	1			
Pump Configuration	Standard			
Pump Function	Infuse/Withdraw			
Pusher Travel Rate Maximum	190.8 mm/min			
Pusher Travel Rate Minimum	0.18 µm/min			
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS			
Step Rate Maximum	26 µsec/µstep			
Step Rate Minimum	27.5 sec/µstep			
Syringe Rack Type	Standard Rack			
Syringe Size Maximum	140 ml			
Syringe Size Minimum	0.5 µl			
USB Connectors	Type B			
Voltage Range	100-240 VAC, 50/60 Hz			
RS 232 Connectors	9 pin D-Sub Connector			

Standard Infusion Only PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks
- Connectivity: RS-232 and USB for PC; RS-485 for daisy chain

Item No.	Description
70-3005	PHD ULTRA™ Syringe Pump Infuse Only Standard
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks

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Features

- New patent pending drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range
- Daisy chain
- Remote configuration available
- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning

- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming - Change the flow with time, volume or a triggered event as many times as you like
- Bolus - Inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery - Calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio - up to three solvents
- I/O — dedicated and user defined I/O

- Pulsed Flow- so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140 ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- **Animal Infusions or Withdrawals**—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- **Proportioning and Delivering of Mixtures**—mixing gradients or proportions with independent control of two liquids.
- **Aerosol for Coating**—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- **Delivery to Mass Spectroscopy**—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.

- **Compensating Flows**—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- **Dispensers/Injectors**—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

The PHD ULTRA™ Syringe Pump is available in three configurations designed for different operating environments and varying degrees of operational flexibility.

Infuse Only: This model supports infusion operations at user-definable flow rates and with selectable target volume or time values to control the total infusion volume. The entry-level Infuse Only model does not include programmable, user-defined methods.

Infuse/Withdraw: This model supports infusion and withdraw operations at user-definable flow rates and with selectable target volumes or time values to control the total volume pumped for both the infusion and withdraw portions of a procedure. This model provides access to many of the advanced method programming options of the PHD ULTRA™, but only supports a single stored method.

Infuse/Withdraw Programmable: This model supports both infusion and withdraw operations and can use both simplified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the PHD ULTRA™, this model also allows users to create and store multiple user-defined methods on the pump.

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, in-line heaters and coolers, nanofluidic circuits, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	70-3005
Accuracy	±0.25%
Classification	Class I
Dimensions **L x D x H**	12.0 x 8.5 x 7.25 in (30.48 x 21.59 x 18.42 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F(-10°C to 70°C)
Flow Rate Maximum	216 ml/min using 140 ml syringe
Flow Rate Minimum	1.5 pl/min using 0.5 µl syringe
I/O & TTL Connectors	15 pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	75 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight	10 lb (4.5 kg)
No of Syringes	2
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800
Pollution Degree	1
Pump Configuration	Standard
Pump Function	Infusion Only
Pusher Travel Rate Maximum	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep

Specifications	**70-3005**
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz
RS-232Connectors	9-pin D-Sub Connector

Standard Infuse/Withdraw Pump 11 Elite Programmable Syringe Pumps

The Pump 11 Elite Series of syringe pumps expands its capabilities to satisfy your experimental requirements. These compact syringe pumps carry on the tradition as the premiere workhorse infusion pump, offering unparalleled ease of use with a high resolution touch screen with intuitive icon interface. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

These syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 60 ml (single syringe) and 0.5 µl to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Series is available in Infusion Only or Infusion/Withdrawal Programmable Models with single or dual syringe racks. These pumps have advanced connectivity with a USB serial port for computer control, RS-485 (or optional RJ-II) ports for daisy chaining pumps and Digital I/O for remote control.

Item No.	Description
70-4504	Pump 11 Elite Infusion/Withdrawal Programmable Single Syringe
70-4505	Pump 11 Elite Infusion/Withdrawal Programmable Dual Syringe

DETAILS

The Pump 11 Elite Series is a family of accurate, low flow syringe pumps designed for use in applications including: mass spec calibration, drug and nutritional studies, reactor dosing, and electrospinning.

The Pump 11 Elite Series of syringe pumps expands its capabilities to satisfy your experimental requirements. These compact syringe pumps carry on the tradition as the premiere workhorse infusion pump, offering unparalleled ease of use with a high resolution touch screen with intuitive icon interface. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

These syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 60 ml (single syringe) and 0.5 µl to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Series is available in Infusion Only or Infusion/Withdrawal Programmable Models with single or dual syringe racks. These pumps have advanced connectivity with a USB serial port for computer control, RS-485 (or optional RJ-11) ports for daisy chaining pumps and Digital I/O for remote control.

Features

- New color LCD touch screen
- Intuitive icon interface
- Up-front control knobs for ease of operation
- Quick start methods
- Program simple to complex methods without a PC
- Relative time clock
- Vertical or horizontal orientation
- 35 lb linear force adjustable across the entire flow range
- Can daisy chain pumps
- CE, CSA, UL, WEEE, EU RoHS, CB Scheme Approved
- 2-year warranty

Applications

- Nanofluidics
- Microfluidics
- Drug/Nutritional studies
- Electrospinning
- Reactor dosing
- Cell injections
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Flow programming
- Binary gradients
- % composition step changes
- I/O interactive experiments

Program Description

To operate the Pump 11 Elite, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

Select a method

Enter operating parameters

Preview your method

Run your method

Advanced Programming Features

- Constant Rate Ramp
- Gradients
- % composition (up to two solvents)
- Autofill
- I/O — dedicated and user defined I/O

Easy-to-Use Interface

The Pump 11 Elite color LCD touch screen with graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Method Main or Quick Start screens are the primary "home" for the pumps. From those screens you can access all the commands needed to operate the Pump 11 Elite, as well as access the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main navigational branches, the quick start Methods, user-defined Methods, and system settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Advanced GLP Documentation Features

- Download experimental parameter information to PC
- Alpha/numeric keypad for method naming

Pump Models

The 11 Elite Syringe Pumps are available in two configurations designed for different operating environments and varying degrees of operational flexibility.

Infusion Only (single and dual syringe models): These models support infusion operations at user-defined flow rates and with selectable target volume or time values to control the total infusion

volume. The Infusion Only models do not include programmable, user-defined methods.

Infusion/Withdrawal Programmable (single and dual syringe models): The models support both infusion and withdrawal operations and can use both simplified pumping profiles or the more advanced pumping profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the Pump 11 Elite, this model also allows users to create and store up to two user-defined methods of 50 steps each on the pump.

Accessories

A full range of accessories are compatible with the Pump 11 Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4504**	**70-4505**
Accuracy	±0.5%	±0.5%
Syringes	1	2
Flow Rate Minimum	1.26 pl/min	1.26 pl/min
Flow Rate Maximum	88.4 ml/min	26.02 ml/min
Classification	Class I	Class I
Dimensions, Control Box L x D x H	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Dimensions, Remote Box L x D x H	N/A	
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F(-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector
Input Power	12-30 VDC	12-30 VDC

Specifications	70-4504	70-4505
Installation Category	II	II
Max Linear Force	35 lb at 100% Force	35 lbs at 100% Force
Mode of Operation	Glucose Clamp	Glucose Clamp
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	4.6 lb (2.1 kg)	4.6 lb (2.1 kg)
No of Syringes	1	2
Non Volatile Memory	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	15,360	15,360
Pollution Degree	1	1
Pump Configuration	Single	Dual
Pump Function	Infuse/Withdraw, Programmable	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	159.8 mm/min	159.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme
Step Rate Maximum	26 µsec/	26 µsec/
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep
Syringe Size Maximum	60 ml	10 ml
Syringe Size Minimum	0.5 µl	0.5 µl
USB Connectors	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Pump 33 DDS (Dual Drive System) Syringe Pump

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a leap forward in syringe pump capability. The Pump 33 DDS has two independent pumping channels controlled by an intuitive touch screen interface.

This multi-purpose syringe pump employs advanced syringe mechanisms that include a tight gripping, extremely secure syringe clamp that accommodates syringe sizes 0.5 µl to 60 ml. The Pump 33 DDS offers enhanced flow performance with high accuracy and smooth flow from 1.02 pl/min to 106 ml/min.

The new Harvard Apparatus Pump 33 DDS employs a graphical user interface controlled with a large 7" LCD Color Touchscreen.

Syringe tables containing all major syringe manufacturers allow simple selection of any compatible syringe size.

Audible Alarms, Adjustable Force and Screen Lock are all features that are available with the touch of the screen.

Features Include:

- Two Independently Controlled pumping channels in one instrument
- Run two separate flows using different directions, flow rates, volumes and syringe sizes
- Intuitive Icon Based Graphical User Interface controlled with a 7" LCD Color Touch Screen Display
- Accommodates Syringe Sizes 0.5 µl to 60 ml
- Smooth flow down to 1.02 pl/min
- High accuracy ± 0.25%
- USB, RS-232 & TTL Connectivity

Item No.	Description
70-3333	Pump 33 DDS (Dual Drive System) Syringe Pump
70-2215	Footswitch (w/ Phono Plug)
70-3340	RS-232 Cable for Pump 33 DDS

DETAILS

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a leap forward in syringe pump capability.

The Pump 33 DDS has two independent pumping channels controlled by an intuitive touch screen interface. This multi-purpose syringe pump employs advanced syringe mechanisms that include a tight gripping, extremely secure syringe clamp that accommodates syringe sizes 0.5 µl to 60 ml. The Pump 33 DDS offers enhanced flow performance with high accuracy and smooth flow from 1.02 pl/min to 106 ml/min.

This new syringe pump employs a graphical user interface controlled with a large 7" LCD color touch screen for quick and easy syringe pump setup. Syringe tables containing all major syringe manufacturers allow simple selection of any compatible syringe size. Audible Alarms, Adjustable Force and Screen Lock are all features that are available with the touch of the screen.

The bright informative display run screen presents the user with all key dispensing parameters in real time.

Features

- Two Independently Controlled pumping channels in one instrument

- Run two separate flows using different directions, flow rates, volumes and syringe sizes
- Intuitive Icon Based Graphical User Interface controlled with a 7” LCD Color Touch Screen Display
- Accommodates Syringe Sizes 0.5 µl to 60 ml
- Smooth flow down to 1.02 pl/min
- High accuracy ± 0.25%
- USB, RS-232 & TTL Connectivity

Operating Conditions

Three operating conditions are available to accommodate a wide range of setups and experimental protocols.

Independent Condition

Independent Condition allows the Pump 33 DDS to operate as two separate syringe pumps named P1 & P2. P1 is syringe position 1, closest to the touch screen interface and P1 is syringe position 2 and is toward the backside of the unit. Each syringe will operate independently with different syringe types, size, force, target (volume or time) and flow rate settings. This innovative condition allows you to run two different flows at the same time using one instrument.

Reciprocating Condition

In reciprocating condition, both syringe channels move in opposite directions at the same rate using the same syringe size and type. When combined with a valve box, the reciprocating condition can provide the continuous fluidic delivery of a peristaltic pump with the accurate pulse free low flow rates provided by a syringe pump.

Twin Condition

The Twin Condition allows both syringes to operate in the same mode using the exact same syringe type, syringe size, force, target (volume or time) and flow rate settings. The pump also allows the user to combine both flows for higher speed and volume infusion applications.

Advanced Connectivity

The Pump 33 DDS comes standard with USB and RS-232 for PC communication and RS-485 for pump-to-pump communication. An entire suite of ASCII commands is available to control the pump remotely with a PC. The pump contains a footswitch input and digital input/output for each independent pumping channel.

Accessories

A full range of accessories are compatible with the Pump 33 DDS (Dual Drive System) Syringe Pump including syringes, connectors, tubing and valve boxes.

SPECIFICATIONS

UNIT SPECIFICATION	PARAMETER
Accuracy	± 0.25 %
Linear Force (Max, per syringe)	70 lb (31.75 kg) at 100% Force Setting up to a flow rate of 90 ml/min using up to a 60 ml syringe with a 32.573 mm inner diameter. 50 lb (22.6 kg) at 100% Force Setting for flow rates 90 ml/min to 106 ml/min using the same size syringe.
Syringe Size:	Two Independent syringe mechanisms (noted as syringe drive P1 & P2)
Minimum	0.5 µl (0.103 mm minimum inner diameter)
Maximum	60 ml (32.573 mm maximum inner diameter)*
Flow Rate:	
Minimum	1.02 pl/min (0.5 ul syringe, 0.103 mm inner diameter)
Maximum	106 ml/min (60 ml syringe, 32.573 mm diameter)
Display	7" WQVGA TFT Color Display with Touch Screen
Modes of Operation:	
Twin Condition	Both syringes of the same size operate identically (flow rate, direction & volume)
Independent Condition	Both syringes operate independently
Reciprocating Condition	Continuous flow, both syringes of the same size operate identically in opposite directions
Non-Volatile Memory	Stores all settings
Pump Command Control	ASCII Command Set
Real time Clock	Yes, with battery backup (battery included and required for real time clock)
Connectors:	
Power	Barrel connector, (-) barrel (+) post 2 mm X 5 mm male plug
RS-485	IEEE-1394, 6 pos (Pump-to-pump communication only)

USB	Type B
RS-232	9 pin D-Sub Connector
(I/O) TTL	15-pin D-sub connector (one for each axis)
Footswitch Connections	Mini phono jack
Drive Motor	Two independent stepper motors
Motor Drive Control	MCU controlled
Step Rate:	
Minimum	27 sec/µstep
Maximum	26 µsec/µstep
Stall Detection	Yes, independent axis stall detection
Input Power	30 V, 2.0 A
Power Supply	Input 100 to 240 VAC, 50/60 Hz, Output 30 V 2.0 A, 50 Watts
Dimensions (L x D x H)	11 x 15 x 8 in (28 cm x 39 cm x 21 cm)
Weight	21 lb (9.09 kg)
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Operating Humidity	80% @ 25° C ambient temperature
Storage Humidity	20% to 80% RH, non-condensing
Classification	Class I
Pollution	Degree 1
Installation	Category II
Regulatory Certifications	CE, ETL (UL & CSA), CB Scheme, EU RoHS, WEEE
*NOTE: Some larger syringes may be compatible with the Pump 33 DDS. Please contact Technical Support for more information.	

Harvard Apparatus Pump Controller (HAPC)

Precision infusion for accurate, reliable and repeatable results is critical to the success of your work. High experiment throughput is essential to keep up with your rapidly changing research area. When using fluidics in research, it can be difficult to know which solution will provide the most reliable and repeatable results, yet best supports high throughput and concurrent experiments.

What if you had a pump controller that would allow you to run multiple infusion experiments – simultaneously or independently, to accelerate experiment throughput without compromising accuracy? And what if that tool provided clear feedback on each experiment-in real time?

The Harvard Apparatus Pump Controller (HAPC) allows configuration and control of up to four pumping channels-independently or simultaneously, using an intuitive, touch screen interface. The HAPC delivers precise infusion and provides clear feedback on the status of each infusion—in real time, across all relevant infusion possibilities.

The HAPC offers preprogrammed flow methods for simple to complex operations that allow you to be up and running with the push of a button. You can even save your flow profiles on the HAPC and use them when needed.

Compatible with Harvard Apparatus Nanomite, PHD ULTRA™ and Pump 11 Elite/Pico Plus Elite stand-alone syringe pumps and syringe pump modules, the controller is easy to set up and easy to use. You can mix pump module types to build the perfect system for your application. The HAPC is an expandable system. Purchase a one, two or three channel system now and add channels as needed.

Choose a controller configuration, select your pumping mechanism and experience complete control over your fluidic experiments.

Infusion Efficiency with World Class Precision

Run up to four independent precision infusion experiments-simultaneously. You can mix pump module types to build the perfect system for your application.

HAPC with Four Nanomite Injectors and Harvard Apparatus Stereotaxic Frame (Frame sold separately)

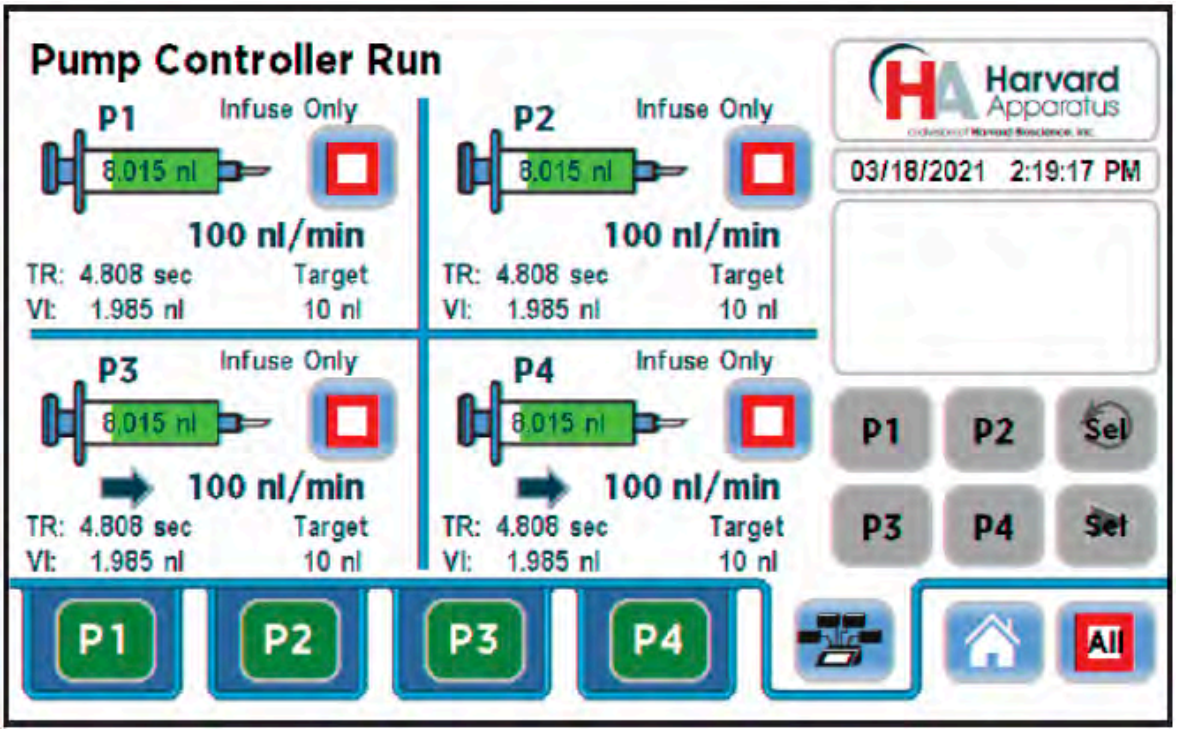
Pump Controller with one Nanomite, PHD ULTRA™, and Pump 11 Elite Family Syringe Pump Modules

Expandable modular system

Add additional channels when you're ready. The HAPC is an expandable system. Easy access to add or remove channels.

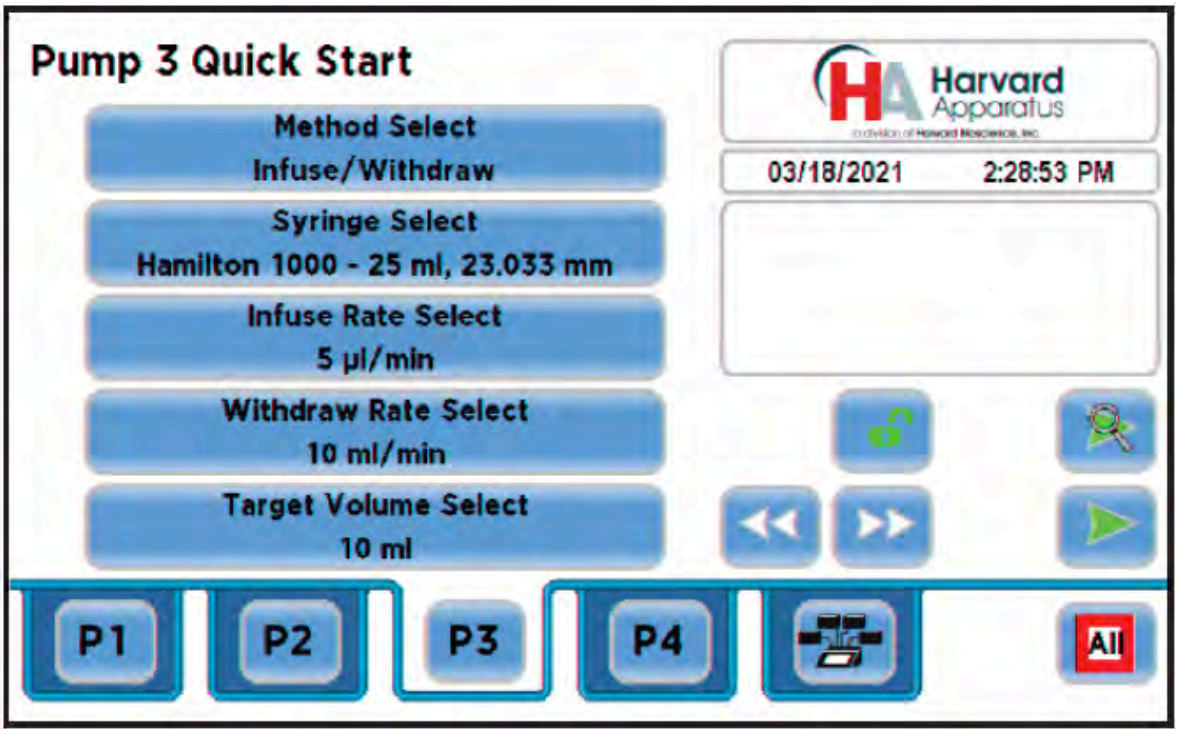
Intuitive User Interface

The intuitive Harvard Apparatus Pump Controller graphical user interface controlled with a large 7” LCD color touch screen display allows quick and easy setup for each channel. The display run screen presents the user with all key dispensing parameters for up to four syringe pumps in real time.



Full Method Programmability

The HAPC offers preprogrammed flow methods for simple to complex operations that allow you to be up and running with the push of a button. You can even save your flow profiles on the HAPC and use them when needed. Create constant rates, flow ramps, bolus, concentration and more!



Syringe Pump Modules

Nanomite Stereotaxic Injector

Nanomite Stereotaxic Injector syringe pump module provides precise, acute stereotaxic infusion. Compatible with all stereotaxic frames, the Nanomite can provide pinpoint accuracy for preclinical neuroscience injections.

Pump 11 Elite

Pump 11 Elite series provides small to medium volume infusion in a compact size and high accuracy. The Pico Plus option provides smooth flow down to the pl/min. Both platforms are available in single and dual syringe configurations.

PHD ULTRA™

PHD ULTRA™ high precision mechanism in a sturdy enclosure. Our smoothest flow with two simultaneous channels. Using four of the PHD ULTRA™ modules will provide eight flow streams. Each PHD ULTRA™ module can run independently of the others for true fluidic flexibility.

PHD ULTRA™ Push/Pull

PHD ULTRA™ Push/Pull high precision continuous flow mechanism. When you need smooth and precise continuous syringe pump flow at peristaltic pump volumes, using four of the PHD ULTRA™ Push/Pull modules will provide four precise continuous flow streams, without the flow pulsatility of a peristaltic pump.

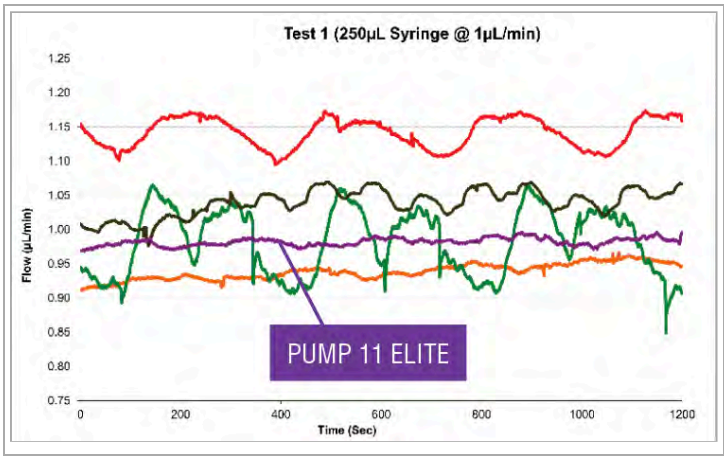
PHD ULTRA™ 4400

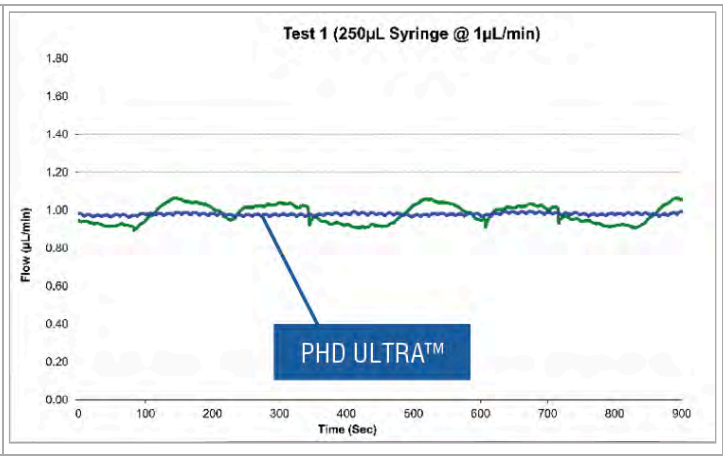
The PHD ULTRA™ 4400 high pressure, enclosed syringe pump component with excellent precisions. Ideal for pumping viscous solutions.

PHD ULTRA™ XF

The PHD ULTRA™ XF our highest pressure four channel syringe pump module. Controlling up to four of these mechanisms can provide sixteen high pressure flow streams.

Harvard Apparatus Syringe Pump Accuracy and Precision





All syringe pumps are not created equal. The graphs above show the flow performance of the Pump 11 Elite and PHD ULTRA™ versus competitive pumps run under the same conditions. The PURPLE and BLUE graphs show the smoothness of our syringe pumps when compared to our competitors (RED, OLIVE, GREEN & ORANGE). When volume accuracy and flow stability are important to your experiments only Harvard Apparatus delivers

Harvard Apparatus offers syringes, tubing, connectors and stereotaxic frames as accessories to our world class syringe pumps.

Item No.	Description

Item No.	Description
70-4400	HAPC-M: 1 Channel Module Upgrade, no controller
70-4401	HAPC-1: Controller populated with one channel module
70-4402	HAPC-2: Controller populated with two channel modules
70-4403	HAPC-3: Controller populated with three channel modules
70-4404	HAPC-4: Controller populated with four channel modules
70-4405	HAPC B: Controller Blank Panel
70-3602	Nanomite Injector, Single Syringe, Black
70-4804	Pump 11 ELITE SINGLE SYRINGE PUMP MODULE (BLACK)
70-4805	Pump 11 ELITE DUAL SYRINGE PUMP MODULE (BLACK)
70-4806	Pump 11 PICO PLUS ELITE DUAL SYRINGE PUMP MODULE (BLACK)
70-4807	Pump 11 PICO PLUS ELITE SINGLE SYRINGE MODULE (BLACK)
70-3406	PHD ULTRA™ Satellite Syringe Pump Infuse/Withdraw
70-3408	PHD ULTRA™ Satellite Syringe Pump Infuse/Withdraw with Push/Pull Mechanism
70-3410	PHD ULTRA™ 4400 Satellite Syringe Pump Infuse/Withdraw
70-3514	PHD ULTRA™ XF Syringe Pump Module with Power Supply
70-2215	Footswitch (w/ Phono Plug)
70-4021	RS-485 Cable for Pump-to-Pump Communication, 1 m (3 ft)

Item No.	Description
70-4001	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite RS-485 Cable for Pump-to-Pump Communication, 2 m
70-4020	RS-485 Cable for Pump-to-Pump Communication, 9 m (30 ft)

DETAILS

CONTROLLER SPECIFICATIONS				
Catalog Number	**70-4401**	**70-4402**	**70-4403**	**70-4404**
Channels	1	2	3	4
Display	7" WQVGA TFT Color Display with Touch Screen			
Mode of Operation	Continuous with Method and conditional syringe pump control features			
Non-Volatile Memory	Stores all settings			
Connectors:				
RS-485	IEEE-1394, 6 pos			
USB	Type B			
I/O & TTL	15 pin D-Sub connector, per channel			

Footswitch	Mini phono jack (one per channel)
8-Pin Phoenix	For channel connection to Nanomite Module
Voltage Range	100-240 VAC, 50/60 Hz
Dimensions (L X W X H)	8.75 x 10 x 6.25 in (22 x 25.4 x 15.87 cm)
Weight (populated with four channels)	2.3 kg (5 lbs)
Atmospheric Conditions:	
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Storage Humidity	20% to 80% RH, non condensing
Power	100 to 240 VAC, 50/60 Hz 50 W, 0.5 A fuse
Classification	Class 1
Pollution Degree	1
Installation Category	II
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
Safety Declarations	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme
EMC Declaration	FCC 47CFR 15B; EN61326-1

MODULE SPECIFICATIONS						
Specifications	**Nanomite Injector**	**Pump 11 Elite Syringe Pump Module**	**Pump 11 Pico Plus Elite Syringe Pump Module**	**PHD ULTRA™ Syringe Pump Module**	**PHD ULTRA™ 4400 Syringe Pump Module**	**PHD ULTRA™ XF Syringe Pump Module**
Item #	**70-3601 (Single)**	**70-4804 (Single) 70-4805 (Dual)**	**70-4806 (Dual) 70-4807 (Single)**	**70-3406 (Dual) 70-3408 (Push/Pull)**	**70-3410 (Single)**	**70-3514 (Four)**
Channels	1	1 or 2	1 or 2	2	1	4
Accuracy	±0.5%	±0.5%	± 0.35%	± 0.25%	± 0.35%	± 0.5%
Syringe (Min./Max.)	0.5 µl / 1 ml	0.5 µl / 60 ml (10 ml dual)	0.5 µl / 60 ml (10 ml dual)	0.5 µl / 140 ml	0.5 µl / 140 ml	20 ml / 200 ml
Flow Rate:						
Minimum	3.66 pl/min (0.5 µl syringe)	1.26 pl/min	0.54 pl/min	3.16 pl/min (0.5 µl syringe)	3.16 pl/min (0.5 µl syringe)	50.7 nl/min (20 ml syringe)
Maximum	3.82 ml/min (1 ml syringe)	88.40 ml/min (26.02 ml/min dual)	39.77 ml/min (11.70 ml/min dual)	215.8 ml/min (140 ml syringe)	215.8 ml/min (140 ml syringe)	144.08 ml/min (200 ml syringe)
Display	None	None	None	None	None	None
Non-Volatile Memory	None (on HAPC)	Stores all settings	Stores all settings	Stores all settings	Stores all settings	Stores all settings
Connectors:						
RS-485	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications

USB	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
I/O & TTL	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
Footswitch	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
RS-232	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
8-Pin Phoenix	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
Linear Force (Max) @ 100% Force selection	5 kg (11 lbs)	16 kg (35 lbs)	16 kg (35 lbs)	34 kg (75 lb)	91 kg (200 lb)	455 kg (1000 lb)
Drive Motor	1.8° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Microsteps/revolution of lead screw	3,200	15,360	20,480	12,800	6,400	32,000
Step Resolution	0.198 µm/µstep	0.069 µm/ µstep	0.031 µm/µstep	0.082 µm/ µstep	0.082 µm/ µstep	0.082 µm/ µstep
Step Rate:						
Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Maximum	52 µsec/µstep	52 µsec/µstep	52 µsec/µstep	26 µsec/µstep	52 µsec/µstep	52 µsec/µstep
Pusher Travel Rate:						
Minimum	0.433 µm/min	0.15 µm/min	0.068 µm/min	0.18 µm/min	0.36 µm/min	0.18 µm/min
Maximum	228.97 mm/min	159.00 mm/min	71.55 mm/min	190.80 mm/min	190.80 mm/min	91.637 mm/min
Stall Detection	No	Yes	Yes	Yes	Yes	Yes
Input Power*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*
Dimensions (L X W X H)	2.5 x 2.0 x 7.5 in (6.35 x 5.08 x 19.05 cm)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	11.75 x 5.5 x 6.5 in (29.8 x 14.0 x 16.5 cm)	11.75 x 5.5 x 6.5 in (29.8 x 14.0 x 16.5 cm)	16 x 12 x 8.5 in (40.64 x 30.48 x 21.6 cm)
Dimensions: Nanomite Mounting post	Length 3.25 in (8.25 cm) OD: 0.312 in (0.793 cm)	Nanomite Only	Nanomite Only	Nanomite Only	Nanomite Only	Nanomite Only
Weight (injector/module only)	0.54kg (1.2 lb)	2.3 kg (5.08 lbs)	2.3 kg (5.08 lbs)	5.1 kg (11.2 lb)	5.3 kg (11.7 lb)	20 kg (44 lb)
Atmospheric Conditions						
Operating Temperature	4°C to 40°C (40°F to 104°deg;F)	4°C to 40°C (40°F to 104°F)	4°C to 40°C (40°F to 104°F)	4°C to 40°C (40°F to 104°F)	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)	-10°C to 70°C (14°F to 158°F)	-10°C to 70°C (14°F to 158°F)	-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	See Chart Below	See Chart Below	See Chart Below	See Chart Below
Storage Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Method of Operation	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous
Classification	Class I	Class I	Class I	Class I	Class I	Class I
Pollution Degree	1	1	1	1	1	1
Installation Category	II	II	II	II	II	II
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
Safety Declarations	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme
EMC Declaration	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1

Note* The Pump 11 Elite, Pico Plus Elite and PHD ULTRA™ XF are fully PC controllable and come with external power supplies. When used with the HAPC, the power supplies are not required. In cases of extremely high pressure applications using the PHD ULTRA XF, the external power supplier may be required. Please contact Technical Support for additional application questions.

SPECIFICATIONS

CONTROLLER SPECIFICATIONS				
Catalog Number	**70-4401**	**70-4402**	**70-4403**	**70-4404**
Channels	1	2	3	4
Display	7" WQVGA TFT Color Display with Touch Screen			
Mode of Operation	Continuous with Method and conditional syringe pump control features			
Non-Volatile Memory	Stores all settings			
Connectors:				
RS-485	IEEE-1394, 6 pos			
USB	Type B			
I/O & TTL	15 pin D-Sub connector, per channel			
Footswitch	Mini phono jack (one per channel)			
8-Pin Phoenix	For channel connection to Nanomite Module			
Voltage Range	100-240 VAC, 50/60 Hz			
Dimensions (L X W X H)	8.75 x 10 x 6.25 in (22 x 25.4 x 15.87 cm)			
Weight (populated with four channels)	2.3 kg (5 lbs)			

Atmospheric Conditions:	
Operating Temperature	4ºC to 40ºC (40ºF to 104ºF)
Storage Temperature	-10ºC to 70ºC (14ºF to 158ºF)
Storage Humidity	20% to 80% RH, non condensing
Power	100 to 240 VAC, 50/60 Hz 50 W, 0.5 A fuse
Classification	Class 1
Pollution Degree	1
Installation Category	II
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
Safety Declarations	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme
EMC Declaration	FCC 47CFR 15B; EN61326-1

MODULE SPECIFICATIONS						
Specifications	**Nanomite Injector**	**Pump 11 Elite Syringe Pump Module**	**Pump 11 Pico Plus Elite Syringe Pump Module**	**PHD ULTRA™ Syringe Pump Module**	**PHD ULTRA™ 4400 Syringe Pump Module**	**PHD ULTRA™ XF Syringe Pump Module**
Item #	**70-3601 (Single)**	**70-4804 (Single) 70-4805 (Dual)**	**70-4806 (Dual) 70-4807 (Single)**	**70-3406 (Dual) 70-3408 (Push/Pull)**	**70-3410 (Single)**	**70-3514 (Four)**
Channels	1	1 or 2	1 or 2	2	1	4
Accuracy	±0.5%	±0.5%	± 0.35%	± 0.25%	± 0.35%	± 0.5%
Syringe (Min./Max.)	0.5 µl / 1 ml	0.5 µl / 60 ml (10 ml dual)	0.5 µl / 60 ml (10 ml dual)	0.5 µl / 140 ml	0.5 µl / 140 ml	20 ml / 200 ml
Flow Rate:						
Minimum	3.66 pl/min (0.5 µl syringe)	1.26 pl/min	0.54 pl/min	3.16 pl/min (0.5 µl syringe)	3.16 pl/min (0.5 µl syringe)	50.7 nl/min (20 ml syringe)
Maximum	3.82 ml/min (1 ml syringe)	88.40 ml/min (26.02 ml/min dual)	39.77 ml/min (11.70 ml/min dual)	215.8 ml/min (140 ml syringe)	215.8 ml/min (140 ml syringe)	144.08 ml/min (200 ml syringe)
Display	None	None	None	None	None	None
Non-Volatile Memory	None (on HAPC)	Stores all settings	Stores all settings	Stores all settings	Stores all settings	Stores all settings
Connectors:						
RS-485	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
USB	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
I/O & TTL	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
Footswitch	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications

RS-232	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
8-Pin Phoenix	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications	See HAPC specifications
Linear Force (Max) @ 100% Force selection	5 kg (11 lbs)	16 kg (35 lbs)	16 kg (35 lbs)	34 kg (75 lb)	91 kg (200 lb)	455 kg (1000 lb)
Drive Motor	1.8° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Microsteps/revolution of lead screw	3,200	15,360	20,480	12,800	6,400	32,000
Step Resolution	0.198 µm/µstep	0.069 µm/ µstep	0.031 µm/µstep	0.082 µm/ µstep	0.082 µm/ µstep	0.082 µm/ µstep
Step Rate:						
Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Maximum	52 µsec/µstep	52 µsec/µstep	52 µsec/µstep	26 µsec/µstep	52 µsec/µstep	52 µsec/µstep
Pusher Travel Rate:						
Minimum	0.433 µm/min	0.15 µm/min	0.068 µm/min	0.18 µm/min	0.36 µm/min	0.18 µm/min
Maximum	228.97 mm/min	159.00 mm/min	71.55 mm/min	190.80 mm/min	190.80 mm/min	91.637 mm/min
Stall Detection	No	Yes	Yes	Yes	Yes	Yes
Input Power*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*	Powered by HAPC*
Dimensions (L X W X H)	2.5 x 2.0 x 7.5 in (6.35 x 5.08 x 19.05 cm)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	11.75 x 5.5 x 6.5 in (29.8 x 14.0 x 16.5 cm)	11.75 x 5.5 x 6.5 in (29.8 x 14.0 x 16.5 cm)	16 x 12 x 8.5 in (40.64 x 30.48 x 21.6 cm)
Dimensions: Nanomite Mounting post	Length 3.25 in (8.25 cm) OD: 0.312 in (0.793 cm)	Nanomite Only	Nanomite Only	Nanomite Only	Nanomite Only	Nanomite Only
Weight (injector/module only)	0.54kg (1.2 lb)	2.3 kg (5.08 lbs)	2.3 kg (5.08 lbs)	5.1 kg (11.2 lb)	5.3 kg (11.7 lb)	20 kg (44 lb)
Atmospheric Conditions						
Operating Temperature	4°C to 40°C (40°F to 104°deg;F)	4°C to 40°C (40°F to 104°F)	4°C to 40°C (40°F to 104°F)	4°C to 40°C (40°F to 104°F)	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)	-10°C to 70°C (14°F to 158°F)	-10°C to 70°C (14°F to 158°F)	-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	See Chart Below	See Chart Below	See Chart Below	See Chart Below
Storage Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Method of Operation	Continuous	Continuous	Continuous	Continuous	Continuous	Continuous

Classification	Class I	Class I	Class I	Class I	Class I	Class I
Pollution Degree	1	1	1	1	1	1
Installation Category	II	II	II	II	II	II
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
Safety Declarations	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme	ANSI/UL 61010-1; CAN/CSA C22.2 No. 61010-1; IEC 61010-1; CB Scheme
EMC Declaration	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1	FCC 47CFR 15B; EN61326-1
Note* The Pump 11 Elite, Pico Plus Elite and PHD ULTRA™ XF are fully PC controllable and come with external power supplies. When used with the HAPC, the power supplies are not required. In cases of extremely high pressure applications using the PHD ULTRA XF, the external power supplier may be required. Please contact Technical Support for additional application questions.						

Remote Infuse/Withdraw PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

Remote Pump Model

The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30 foot RS-485 (IEEE-1394) cable. This makes the pump ideal for use in hazardous environments where the researcher is safer distanced from the material being pumped or for applications where you need to have the pumping mechanism inside an incubator. Every version of the PHD ULTRA™ is available in a remote model.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. Integrated EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC
   - Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
   - LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
   a. Configurations: push-pull, standard, remote, high pressure, multi racks
   b. Connectivity: RS-232 and USB for PC; RS-485 for pump to pump daisy chain

Item No.	Description
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

Features

- Superior drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- Color LCD touchscreen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range
- Daisy chain
- Remote configuration available
- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning
- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming

- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Remote Pump Model

The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30 foot RS-485 (IEEE-1394) cable. This makes the pump ideal for use in hazardous environments where the researcher is safer distanced from the material being pumped or for applications where you need to have the pumping mechanism inside an incubator. Every version of the PHD ULTRA™ is available in a remote model.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)
a. Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only
b. LCD, high resolution color touch screen for powerful functionality, yet easy to use

Multiple levels of versatility
a. Configurations: push-pull, standard, remote, high pressure, multi racks
b. Connectivity: RS 232 and USB for PC; RS 485 for daisy chain

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Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming—change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O—dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- Animal Infusions or Withdrawals—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	70-3306	70-3307	70-3308	70-3309
Accuracy	±0.25%	±0.25%	±0.25%	±0.25%
Classification	Class I	Class I	Class I	Class I
Dimensions,Control Box L x D x H	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)		
Dimensions, Remote Box L x D x H	11.0 x 5.3 x 6.5 in (27.94 x 13.46 x 16.51 cm)			
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F 4°C to 40°C	40°F to 104°F 4°C to 40°C	40°F to 104°F 4°C to 40°C	40°F to 104°F 4°C to 40°C
Environmental Storage Temperature	14°F to 158°F -10°C to 70°C	14°F to 158°F -10°C to 70°C	14°F to 158°F -10°C to 70°C	14°F to 158°F -10°C to 70°C
Flow Rate Maximum	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe
Flow Rate Minimum	1.5 pl/min using 0.5 µl syringe	1.5 pl/min using 0.5 µl syringe	1.5 pl/min using 0.5 µl syringe	1.5 pl/min using 0.5 µl syringe
I/O & TTL Connectors	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector
Input Power	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse
Installation Category	II	II	II	II
Max Linear Force	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection
Mode of Operation	Continuous	Continuous	Continuous	Continuous

Specifications	70-3306	70-3307	70-3308	70-3309
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	13.4 lb (6.1 kg)	13.4 lb (6.1 kg)	13.4 lb (6.1 kg)	13.4 lb (6.1 kg)
No of Syringes	2	2	4	4
Non Volatile Memory	Storage of all settings	Storage of all settings	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800	12,800	12,800	12,800
Pollution Degree	1	1	1	1
Pump Configuration	Remote	Remote	Remote	Remote
Pump Function	Infuse/Withdraw	Infuse/Withdraw, Programmable	Push/Pull	Push/Pull, Programmable
Pusher Travel Rate Maximum	190.8 mm/min	190.8 mm/min	190.8 mm/min	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min	0.18 µm/min	0.18 µm/min
RS 232 Connectors	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector
Regulatory Certifications	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Syringe Rack Type	Standard Rack	Standard Rack	Standard Rack	Standard Rack
Syringe Size Maximum	140 ml	140 ml	140 ml	140 ml
Syringe Size Minimum	0.5 µl	0.5 µl	0.5 µl	0.5 µl
USB Connectors	Type B	Type B	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Remote Infusion Only PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This remote infusion only syringe pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

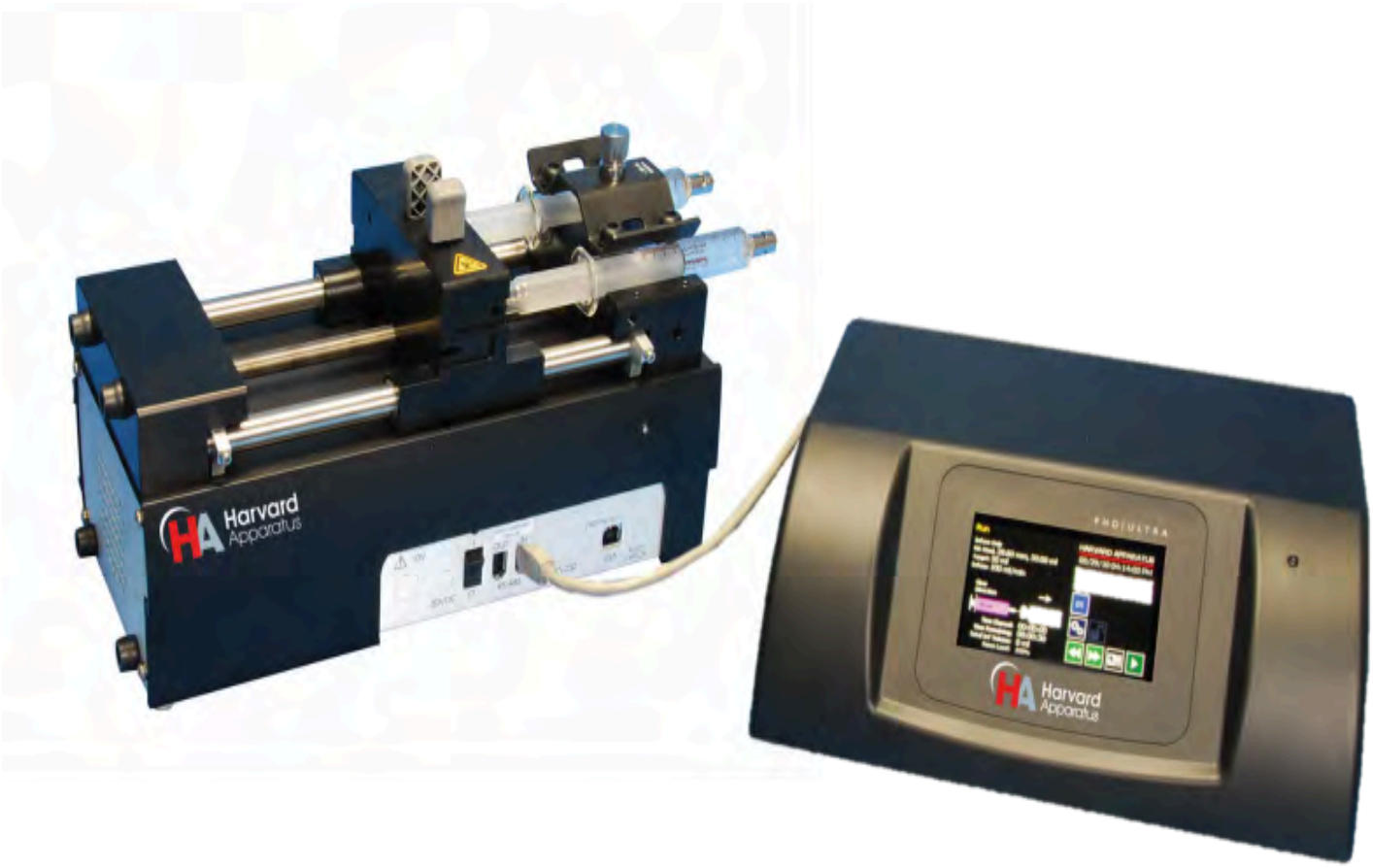
The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

EZ PRO Software and user interface allow easy syringe set up
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

Connectivity: RS 232 and USB for PC; RS 485 for daisy chain

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)



DETAILS

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This remote infusion only syringe pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

EZ PRO Software and user interface allow easy syringe set up
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

Connectivity—RS 232 and USB for PC; RS 485 for daisy chain

Features

- Advanced drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Quick start infusion method
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lb across the entire flow range
- Daisy chain
- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning
- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140 ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Quick Start screen is the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- **Animal Infusions**—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- **Proportioning and Delivering of Mixtures**—mixing gradients or proportions with independent control of two liquids.
- **Aerosol for Coating**—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- **Delivery to Mass Spectroscopy**—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.

- **Compensating Flows**—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- **Dispensers/Injectors**—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

This version of the PHD ULTRA™ Syringe Pump is available in infuse only (other models available).

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, in-line heaters and coolers, nanofluidic circuits, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-3305**
Accuracy	±0.25%
Classification	Class I
Dimensions, Control Box, L x D x H	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)
Dimensions, Remote Box L x D x H	11.0 x 5.3 x 6.5 in (27.94 x 13.46 x 16.51 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad

Specifications	70-3305
Drive Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	216 ml/min using 140 ml syringe
Flow Rate Minimum	1.5 pl/min using 0.5 µl syringe
I/O & TTL Connectors	15 pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	75 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight	13.4 lb (6.1 kg)
No of Syringes	2
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800
Pollution Degree	1
Pump Configuration	Remote
Pump Function	Infusion Only
Pusher Travel Rate Maximum	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min
RS-232 Connector	9 pin D-Sub Connector
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz

Standard PHD ULTRA™ CP Syringe Pump

The PHD ULTRA™ CP Syringe Pump is the first of its kind to allow operation under constant pressure or constant flow. Historically, the only means available to dispense at constant pressure has involved the use of various amplifiers and other accessories/software. The PHD ULTRA™ CP Syringe Pump, when combined with virtually any commercially available pressure transducer/amplifier combination with 0 to 10 VDC analog output, results in a constant pressure dispensing system. This system can deliver fluids with an applied force up to 1,000 lb (depending upon the pump).

Using Harvard Apparatus syringe pump technology and software-controlled pressure monitoring, the PHD ULTRA™ CP Syringe Pump is able to maintain a user-defined system pressure ±2%. A user-adjustable sensitivity setting allows for the customization of the system response time necessary to attain the set pressure. The PHD ULTRA™ CP Syringe Pump allows the user to set pressures in the units of their choice including mmHg, kPa, and psi.

Item No.	Description
88-3015	PHD ULTRA™ CP Syringe Pump Infuse/Withdraw Programmable

DETAILS

The PHD ULTRA™ CP Syringe Pump is the first of its kind to allow operation under constant pressure or constant flow. Historically, the only means available to dispense at constant pressure has involved the use of various amplifiers and other accessories/software. The PHD ULTRA™ CP Syringe Pump, when combined with virtually any commercially available pressure transducer/amplifier combination with 0 to 10 VDC analog output, results in a constant pressure dispensing system. This sytem can deliver fluids with an applied force up to 1,000 lb (depending upon the pump).

Features

- Enables continuous pressure-controlled infusion
- Use in constant flow or constant pressure mode
- Enhances safety for sensitive infusion targets and physiological experimentation
- Compatible with a wide range of pressure transducers
- Automatically adjusts flow rate to maintain constant pressure
- Alpha/numeric keyboard without a PC

- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range • PC Application Included (For dataloging and PC control if required)
- CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme Approved
- 2-year warranty

Applications

- Short-term organ perfusion studies that require the maintenance of physiologic conditions.
- Introduction of chemical reactants in a controlled manner.
- Ocular injections and perfusions.
- Small animal whole-body perfusions.
- Constant pressure microfluidic mixing.
- Administration of genetic material into organs without viral vectors.

Superior Functionality

Using Harvard Apparatus syringe pump technology and software-controlled pressure monitoring, the PHD ULTRA™ CP Syringe Pump is able to maintain a user-defined system pressure ±2%.

A user-adjustable sensitivity setting allows for the customization of the system response time necessary to attain the set pressure. The PHD ULTRA™ CP Syringe Pump allows the user to set pressures in the units of their choice including mmHg, kPa, and psi.

Essential Application Tools

The PHD ULTRA™ CP Syringe Pump can work with any pressure transducer and amplifier that will output a 0-10V or similar signal. We offer a wide variety of pressure transducers and amplifiers to suit your particular application. Our most popular physiological pressure transducer is our APT-300, a fluid-filled unit with a pressure range of ±300 mmHg and a sensitivity of 5µV/V/mmHg (±1%). This has an easily replaceable transducer head. For low pressure applications, such as maintaining the pressure in an eye, we have the P75 Venous Pressure Transducer. This pressure transducer has a pressure range of 75 mmHg and a sensitivity of 1mV/mmHg. When the customer requires a separate amplifier, the unit of choice is the model
601 Transducer AmplifierModule, or TAM-A. As a PLUGSYS module, this DC Bridge Amplifier requires the use of a PLUGSYS housing with a power supply. Cases holding 2, 5, or 10 modules are available.

Pressure & Flow Rate Data

Data can be monitored via RS-232 from the PHD ULTRA™ CP Syringe Pump to a PC. In practice, the 0-10V analog output of a pressure transducer amplifier is connected to the analog input on the rear panel of the pump. The amplifier or signal conditioner can be provided by the customer, or accomplished with various tranducers and amplifiers available from Harvard Apparatus. The pressure range may be scaled to fit the available transducer voltage output for systems that output less than 10 V. While in constant pressure mode, in addition to the set and actual pressure, the pump displays the flow rate. This data may be output for further analysis with a variety of data acquisition packages.

Accuracy & Reproducibility

In addition to constant pressure mode, the PHD ULTRA™ CP may also be used in flow mode with its worldrenowned accuracy and reproducibility.
All PHD ULTRA™ CP Syringe Pumps are infuse/withdraw programmable models. When used in flow mode, these offer programmable features such as method storage and flow programming functions to allow the user to create simple to complex methods. The PHD ULTRA™ CP Syringe Pump is available in a variety of configurations to suit the desired pressure or flow rate ranges.

Advanced Programming Features

- Flow Programming —change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O—dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 1.56 pl/min to 215.8 ml/min.

Maximum Experimental Versatility

The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchased with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140ml syringe rack and 4 x microliter syringe rack.

Description of Typical Applications

- Animal Infusions or Withdrawals—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

SPECIFICATIONS

Specifications	**88-3015**
Classification	Class I
Dimensions **L x D x H**	12.0 x 8.5 x 4.0 in (30.48 x 21.59 x 10.16 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Accuracy	±0.25%
Flow Rate Maximum	215.8 ml/min using 140 ml syringe
Flow Rate Minimum	1.56 pl/min using 0.5 µl syringe
I O TTL Connectors	15 pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	75 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping

Specifications **88-3015**

Net Weight	10 lb (4.5 kg)
No of Syringes	2
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800
Pollution Degree	1
Pressure Accuracy	±2%
Pump Configuration	Standard
Pump Function	Infuse/Withdraw Programmable
Pusher Travel Rate Maximum	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min
RS 232 Connectors	9 pin D-Sub Connector
Regulatory Certifications	CE, ETL, (UL, CSA), WEEE, EU RoHS & CB Scheme
Step Rate Maximum	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz
Classification	Class I

Remote Infuse/Withdraw Pump 11 Elite Nanomite Programmable Syringe Pump

The Pump 11 Elite Nanomite is a single syringe infusion/withdrawal programmable syringe pump with a flow rate range of 3.66 pl/min to 3.818 ml/min with 11 lb of adjustable force across the entire flow rate range. It can accommodate syringes from 0.5 µl to 1 ml.

The Pump 11 Elite Nanomite Syringe Pump is very easy to use with an LCD color touch screen and icon interface. This pump allows you to create, save and run simple to complex Methods without a PC. The Method profiles available on this pump are Constant Rate, Ramp, Gradient (binary) and Autofill. Delays can be set using the relative time clock.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation. The Run Screen shows all of the pump parameters on one screen for easy review.

Item No.	Description
70-4507	Pump 11 Elite Nanomite Infusion/Withdrawal Programmable Syringe Pump
70-2277	Nanomite Kit for Direct Injection

DETAILS

The Pump 11 Elite Nanomite is a single syringe infusion/withdrawal programmable syringe pump with a flow rate range of 3.66 pl/min to 3.818 ml/min with 11 lb of adjustable force across the entire flow rate range. It can accommodate syringes from 0.5 µl to 1 ml.

Features

- Easy-to-use LCD color touch screen with GUI interface
- Light weight makes it ideal for hand-held or stereotaxic injection
- Up-front control knobs for ease of operation
- Quick start methods
- Easily Program simple to complex methods without a PC
- Relative time clock
- Vertical or horizontal orientation
- 11 lb linear force adjustable across the entire flow range

- Can daisy chain pumps
- CE, ETL (CSA, UL), WEEE, EU RoHS, CB Scheme Approved
- 2-year warranty

Applications

- Cellular Injections
- Drug Delivery
- Microinjections
- Hand-held Automated Delivery
- Stereotaxic Injections
- Feeding Cells
- Regenerative Medicine

The Pump 11 Elite Nanomite Syringe Pump is very easy to use with an LCD color touch screen and icon interface. This pump allows you to create, save and run simple to complex Methods without a PC. The Method profiles available on this pump are Constant Rate, Ramp, Gradient (binary) and Autofill. Delays can be set using the relative time clock.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation. The Run Screen shows all of the pump parameters on one screen for easy review.

The software is organized into three main navigational branches, the quick start Methods, user-defined Methods, and system settings. You can control operations directly through the touch screen or remotely from an independent computer or device via the external I/O interface.

The Pump 11 Elite Nanomite has a footswitch input, USB serial port for computer control, RS-485 ports for daisy chaining pumps and Digital I/O for external control via an independent computer or device. There is also an option for daisy chaining pumps through the RS-232 (RJ-11) ports. This option must be ordered at the time the pump is ordered.

This pump consists of a control unit, an injection unit, a 6-foot cable to connect the two units and a footswitch.

SPECIFICATIONS

Specifications	70-4507
Accuracy	±0.5%
Classification	Class I
Dimensions, Control Box, L x D x H	9.0 x 7.0 x 3.67 in (22.6 x 17.78 x 9.32 cm)
Dimensions, Mechanism, L x D x H	2.5 x 2.0 x 7.5 in (6.35 x 5.08 x 19.05 cm)
Mechanism Mounting Post, OD	0.3125â€ (0.793 cm) OD
Mechanism Mounting Post, Length	3.25â€ (8.25 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	3.818 ml/min using 1 ml syringe
Flow Rate Minimum	3.66 pl/min using 0.5 µl syringe
I O TTL Connectors	15-pin D-Sub Connector
Input Power	12-30 VDC
Installation Category	II
Max Linear Force	11 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight, Control Box	4.32 lb (1.96 kg)
Net Weight, Remote Mechanism	1.01 lb (0.458 kg)
No of Syringes	1
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	3,200
Pollution Degree	1
Pump Configuration	Remote
Pump Function	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	228.97 mm/min
Pusher Travel Rate Minimum	0.433 µm/min
RS 232 Connectors	optional RJ-11

Specifications	70-4507
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
Step Rate Maximum	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	1 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz

Pump 33 DDS (Dual Drive System) Syringe Pump

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a leap forward in syringe pump capability. The Pump 33 DDS has two independent pumping channels controlled by an intuitive touch screen interface.

This multi-purpose syringe pump employs advanced syringe mechanisms that include a tight gripping, extremely secure syringe clamp that accommodates syringe sizes 0.5 µl to 60 ml. The Pump 33 DDS offers enhanced flow performance with high accuracy and smooth flow from 1.02 pl/min to 106 ml/min.

The new Harvard Apparatus Pump 33 DDS employs a graphical user interface controlled with a large 7" LCD Color Touchscreen.

Syringe tables containing all major syringe manufacturers allow simple selection of any compatible syringe size.

Audible Alarms, Adjustable Force and Screen Lock are all features that are available with the touch of the screen.

Features Include:

- Two Independently Controlled pumping channels in one instrument
- Run two separate flows using different directions, flow rates, volumes and syringe sizes
- Intuitive Icon Based Graphical User Interface controlled with a 7" LCD Color Touch Screen Display
- Accommodates Syringe Sizes 0.5 µl to 60 ml
- Smooth flow down to 1.02 pl/min
- High accuracy ± 0.25%
- USB, RS-232 & TTL Connectivity

Item No.	Description
70-3333	Pump 33 DDS (Dual Drive System) Syringe Pump
70-2215	Footswitch (w/ Phono Plug)
70-3340	RS-232 Cable for Pump 33 DDS

DETAILS

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a leap forward in syringe pump capability.

The Pump 33 DDS has two independent pumping channels controlled by an intuitive touch screen interface. This multi-purpose syringe pump employs advanced syringe mechanisms that include a tight gripping, extremely secure syringe clamp that accommodates syringe sizes 0.5 µl to 60 ml. The Pump 33 DDS offers enhanced flow performance with high accuracy and smooth flow from 1.02 pl/min to 106 ml/min.

This new syringe pump employs a graphical user interface controlled with a large 7" LCD color touch screen for quick and easy syringe pump setup. Syringe tables containing all major syringe manufacturers allow simple selection of any compatible syringe size. Audible Alarms, Adjustable Force and Screen Lock are all features that are available with the touch of the screen.

The bright informative display run screen presents the user with all key dispensing parameters in real time.

Features

- Two Independently Controlled pumping channels in one instrument

- Run two separate flows using different directions, flow rates, volumes and syringe sizes
- Intuitive Icon Based Graphical User Interface controlled with a 7” LCD Color Touch Screen Display
- Accommodates Syringe Sizes 0.5 µl to 60 ml
- Smooth flow down to 1.02 pl/min
- High accuracy ± 0.25%
- USB, RS-232 & TTL Connectivity

Operating Conditions

Three operating conditions are available to accommodate a wide range of setups and experimental protocols.

Independent Condition

Independent Condition allows the Pump 33 DDS to operate as two separate syringe pumps named P1 & P2. P1 is syringe position 1, closest to the touch screen interface and P1 is syringe position 2 and is toward the backside of the unit. Each syringe will operate independently with different syringe types, size, force, target (volume or time) and flow rate settings. This innovative condition allows you to run two different flows at the same time using one instrument.

Reciprocating Condition

In reciprocating condition, both syringe channels move in opposite directions at the same rate using the same syringe size and type. When combined with a valve box, the reciprocating condition can provide the continuous fluidic delivery of a peristaltic pump with the accurate pulse free low flow rates provided by a syringe pump.

Twin Condition

The Twin Condition allows both syringes to operate in the same mode using the exact same syringe type, syringe size, force, target (volume or time) and flow rate settings. The pump also allows the user to combine both flows for higher speed and volume infusion applications.

Advanced Connectivity

The Pump 33 DDS comes standard with USB and RS-232 for PC communication and RS-485 for pump-to-pump communication. An entire suite of ASCII commands is available to control the pump remotely with a PC. The pump contains a footswitch input and digital input/output for each independent pumping channel.

Accessories

A full range of accessories are compatible with the Pump 33 DDS (Dual Drive System) Syringe Pump including syringes, connectors, tubing and valve boxes.

SPECIFICATIONS

UNIT SPECIFICATION	PARAMETER
Accuracy	± 0.25 %
Linear Force (Max, per syringe)	70 lb (31.75 kg) at 100% Force Setting up to a flow rate of 90 ml/min using up to a 60 ml syringe with a 32.573 mm inner diameter. 50 lb (22.6 kg) at 100% Force Setting for flow rates 90 ml/min to 106 ml/min using the same size syringe.
Syringe Size:	Two Independent syringe mechanisms (noted as syringe drive P1 & P2)
Minimum	0.5 µl (0.103 mm minimum inner diameter)
Maximum	60 ml (32.573 mm maximum inner diameter)*
Flow Rate:	
Minimum	1.02 pl/min (0.5 ul syringe, 0.103 mm inner diameter)
Maximum	106 ml/min (60 ml syringe, 32.573 mm diameter)
Display	7" WQVGA TFT Color Display with Touch Screen
Modes of Operation:	
Twin Condition	Both syringes of the same size operate identically (flow rate, direction & volume)
Independent Condition	Both syringes operate independently
Reciprocating Condition	Continuous flow, both syringes of the same size operate identically in opposite directions
Non-Volatile Memory	Stores all settings
Pump Command Control	ASCII Command Set
Real time Clock	Yes, with battery backup (battery included and required for real time clock)
Connectors:	
Power	Barrel connector, (-) barrel (+) post 2 mm X 5 mm male plug
RS-485	IEEE-1394, 6 pos (Pump-to-pump communication only)

USB	Type B
RS-232	9 pin D-Sub Connector
(I/O) TTL	15-pin D-sub connector (one for each axis)
Footswitch Connections	Mini phono jack
Drive Motor	Two independent stepper motors
Motor Drive Control	MCU controlled
Step Rate:	
Minimum	27 sec/µstep
Maximum	26 µsec/µstep
Stall Detection	Yes, independent axis stall detection
Input Power	30 V, 2.0 A
Power Supply	Input 100 to 240 VAC, 50/60 Hz, Output 30 V 2.0 A, 50 Watts
Dimensions (L x D x H)	11 x 15 x 8 in (28 cm x 39 cm x 21 cm)
Weight	21 lb (9.09 kg)
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Operating Humidity	80% @ 25° C ambient temperature
Storage Humidity	20% to 80% RH, non-condensing
Classification	Class I
Pollution	Degree 1
Installation	Category II
Regulatory Certifications	CE, ETL (UL & CSA), CB Scheme, EU RoHS, WEEE
*NOTE: Some larger syringes may be compatible with the Pump 33 DDS. Please contact Technical Support for more information.	

CMA 4004 Microdialysis Syringe Pump

The CMA 4004 Touch Screen Syringe Pump is a totally new design that is easy-to-use and can hold four syringes, providing very broad flow ranges rate suitable for microdialysis.

Item No.	Description
CMA400400	CMA 4004 Microdialysis Touch Screen Syringe Pump

DETAILS

The CMA 4004 Syringe Pump is a totally new design that is easy-to-use and can hold four syringes, providing very broad flow ranges rate suitable for microdialysis. In addition, the pump can deliver very precise micro-injections that can be repeated in intervals.

- Four syringe carriage
- Ability to use non-standard syringe types
- Pulse free flow
- Flow rates from 0.54 pL/min to 11.70 mL /min
- Quick setup using the builet-in syringe library
- Email methods to your peers, download methods and upgrade your software remotely

Using the high resolution LCD color touch screen makes it very easy to program and recall methods. The direction of flow can easily be reversed for experiments requiring fluid withdrawal. The CMA 4004 Syringe Pump has the ability to run in a horizontal or vertical orientation. This allows choosing the proper orientation based on the experiment setup. The CMA 4004 is equipped with RS-485 for daisy chaining pumps and Digital I/O for remote control as well as USB serial port for computer control.

The CMA 4004 microdialysis syringe pump is provided with 2 years warranty.

SPECIFICATIONS

Specifications	**CMA400400**
Pump Configuration	Standard
Pump Function	Infusion/Withdrawal/Programmable
Flow Rate Maximum	11.70 ml/min using 10 ml syringe
Flow Rate Minimum	0.54 pl/min using 0.5 Âµl syringe
Syringe Size Minimum	0.5 Âµl
Syringe Size Maximum	10 ml
Max Linear Force	35 lbs @ 100% Force Selection
I O TTL Connectors	15 pin D-Sub Connector
RS 232 Connectors	optional RJ-11
USB Connectors	Type B
Accuracy	Â±0.35%
Non Volatile Memory	Storage of all settings
Drive Motor	0.9Â° Stepper Motor

Specifications	CMA400400
Motor Drive Control	Microprocessor with 1/16 microstepping
Number of Microsteps per one rev of Lead Screw	20,480
Step Rate Minimum	27.5 sec/Âµstep
Step Rate Maximum	26 Âµsec/Âµstep
Pusher Travel Rate Minimum	0.068 Âµm/min
Pusher Travel Rate Maximum	71.55 mm/min
Display	4.3" WQVGA TFT Color Display with Touchpad
Input Power	12-30 VDC
Voltage Range	100-240 VAC, 50/60 Hz
Dimensions Control Box LxDxH in cm	9.0 x 7.0 x 6.0 (22.6 x 17.78 x 15.0)
Net Weight Metric	2.1 kg
Net Weight English	4.6 lb
Environmental Operating Temperature Metric	4Â°C to 40Â°C
Environmental Operating Temperature English	40Â°F to 104Â°F
Environmental Storage Temperatue Metric	-10Â°C to 70Â°C
Environmental Storage Temperatue English	14Â°F to 158Â°F
Environmental 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

Remote Infuse/Withdraw Pump 11 Elite Nanomite Programmable Syringe Pump

The Pump 11 Elite Nanomite is a single syringe infusion/withdrawal programmable syringe pump with a flow rate range of 3.66 pl/min to 3.818 ml/min with 11 lb of adjustable force across the entire flow rate range. It can accommodate syringes from 0.5 µl to 1 ml.

The Pump 11 Elite Nanomite Syringe Pump is very easy to use with an LCD color touch screen and icon interface. This pump allows you to create, save and run simple to complex Methods without a PC. The Method profiles available on this pump are Constant Rate, Ramp, Gradient (binary) and Autofill. Delays can be set using the relative time clock.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation. The Run Screen shows all of the pump parameters on one screen for easy review.

Item No.	Description
70-4507	Pump 11 Elite Nanomite Infusion/Withdrawal Programmable Syringe Pump
70-2277	Nanomite Kit for Direct Injection

DETAILS

The Pump 11 Elite Nanomite is a single syringe infusion/withdrawal programmable syringe pump with a flow rate range of 3.66 pl/min to 3.818 ml/min with 11 lb of adjustable force across the entire flow rate range. It can accommodate syringes from 0.5 µl to 1 ml.

Features

- Easy-to-use LCD color touch screen with GUI interface
- Light weight makes it ideal for hand-held or stereotaxic injection
- Up-front control knobs for ease of operation
- Quick start methods
- Easily Program simple to complex methods without a PC
- Relative time clock
- Vertical or horizontal orientation
- 11 lb linear force adjustable across the entire flow range

- Can daisy chain pumps
- CE, ETL (CSA, UL), WEEE, EU RoHS, CB Scheme Approved
- 2-year warranty

Applications

- Cellular Injections
- Drug Delivery
- Microinjections
- Hand-held Automated Delivery
- Stereotaxic Injections
- Feeding Cells
- Regenerative Medicine

The Pump 11 Elite Nanomite Syringe Pump is very easy to use with an LCD color touch screen and icon interface. This pump allows you to create, save and run simple to complex Methods without a PC. The Method profiles available on this pump are Constant Rate, Ramp, Gradient (binary) and Autofill. Delays can be set using the relative time clock.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation. The Run Screen shows all of the pump parameters on one screen for easy review.

The software is organized into three main navigational branches, the quick start Methods, user-defined Methods, and system settings. You can control operations directly through the touch screen or remotely from an independent computer or device via the external I/O interface.

The Pump 11 Elite Nanomite has a footswitch input, USB serial port for computer control, RS-485 ports for daisy chaining pumps and Digital I/O for external control via an independent computer or device. There is also an option for daisy chaining pumps through the RS-232 (RJ-11) ports. This option must be ordered at the time the pump is ordered.

This pump consists of a control unit, an injection unit, a 6-foot cable to connect the two units and a footswitch.

SPECIFICATIONS

Specifications	70-4507
Accuracy	±0.5%
Classification	Class I
Dimensions, Control Box, L x D x H	9.0 x 7.0 x 3.67 in (22.6 x 17.78 x 9.32 cm)
Dimensions, Mechanism, L x D x H	2.5 x 2.0 x 7.5 in (6.35 x 5.08 x 19.05 cm)
Mechanism Mounting Post, OD	0.3125â€ (0.793 cm) OD
Mechanism Mounting Post, Length	3.25â€ (8.25 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	3.818 ml/min using 1 ml syringe
Flow Rate Minimum	3.66 pl/min using 0.5 µl syringe
I O TTL Connectors	15-pin D-Sub Connector
Input Power	12-30 VDC
Installation Category	II
Max Linear Force	11 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight, Control Box	4.32 lb (1.96 kg)
Net Weight, Remote Mechanism	1.01 lb (0.458 kg)
No of Syringes	1
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	3,200
Pollution Degree	1
Pump Configuration	Remote
Pump Function	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	228.97 mm/min
Pusher Travel Rate Minimum	0.433 µm/min
RS 232 Connectors	optional RJ-11

Specifications	70-4507
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
Step Rate Maximum	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	1 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz

CMA 402 Microdialysis Syringe Pump

The CMA 402 Syringe Pump is a compact, flexible, dual syringe pump designed for low pulse-free flow rates suitable for microdialysis experiments and other low flow experiments. Start/Stop and flow rate can be set individually for each syringe.

The pump is precalibrated for 1, 2.5 or 5 mL syringes with flow rates between 0.1 µL/min and 20 µL/min. The flow rates are shown on the LED displays. The CMA 402 Microdialysis Pump is even more flexible when controlled by a computer through the RS-232 interface. For instance, a preset volume can easily be set. A flush feature fills the system at a flow rate of 25 µL/min. The CMA 402 is available in two different versions, one of which includes accessories such as vial holders and probe clips, allowing easier handling of the microdialysis probe.

Item No.	Description
CMA8003100	CMA 402 Microdialysis Syringe Pump with Accessory Kit
CMA8003110	CMA 402 Microdialysis Syringe Pump

DETAILS

The CMA 402 Syringe Pump is a compact, flexible, dual syringe pump designed for low pulse-free flow rates suitable for microdialysis experiments and other low flow experiments.

- Dual syringes independently controlled
- Flow rates from 0.1- 20 µL/min
- Independent flow directions to infuse or withdraw

Start/Stop and flow rate can be set individually for each syringe. The pump is precalibrated for 1, 2.5 or 5 mL syringes with flow rates between 0.1 µL/min and 20 µL/min. The flow rates are shown on the LED displays. The CMA 402 Microdialysis Pump is even more flexible when controlled by a computer through the RS-232 interface. For instance, a preset volume can easily be set. A flush feature fills the system at a flow rate of 25 µL/min. The CMA 402 is available in two different versions, one of which includes accessories such as vial holders and probe clips, allowing easier handling of the microdialysis probe.

SPECIFICATIONS

Specifications	CMA8003100	CMA8003110
Accuracy	±1.5%	±1.5%
Calibration	Precalibrated	Precalibrated
Certifications	CE	CE
Computer connection	RS232 and USB	RS232 and USB
Dimensions	207 x 135 x 48 mm (W x D x H)	207 x 135 x 48 mm (W x D x H)
Display	2-digit LED display showing flow rate or syringe size	2-digit LED display showing flow rate or syringe size
External connections	Variable	Variable
Fast Feed	Approx.20 µL/min (with 1 mL syringe)	Approx.20 µL/min (with 1 mL syringe)
Flow rate range	0.1 µL/min - 20 µL/min	0.1 µL/min - 20 µL/min
Motor	High resolution step motor system	High resolution step motor system
Motor Drive Control	-	-
Number of syringes	2, Indep. Control	2, Indep. Control
Piston carriage speed	2.4 µm/min-1.2 mm/min	2.4 µm/min-1.2 mm/min
Power consumption	10 W max	10 W max
Speed variation	±1.5%	±1.5%
Syringe sizes	1, 2.5 and 5 mL, piston stroke 60 mm	1, 2.5 and 5 mL, piston stroke 60 mm
Voltage	100-240 VAC 50-60 Hz, output 12 VDC (adapter included)	100-240 VAC 50-60 Hz, output 12 VDC (adapter included)
Weight	approx. 1.4 kg	approx. 1.4 kg
Working temperature	10-35°C	10-35°C

Standard Infuse/Withdraw Pump 11 Pico Plus Elite Programmable Syringe Pump

The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite is the lowest flow, highest accuracy pump with unparalleled ease of use with a high resolution touch screen with intuitive icon interface. It can deliver volumes down to 0.54 pl/min. This infusion/withdrawal dual syringe pump is ideal for applications such as microdialysis. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

This syringe pump has a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 10 ml (dual channel version) or 0.5 µl to 60 ml (single channel version). The Pump 11 Pico Plus Elite offers enhanced flow performance with high accuracy and smooth flow from 0.54 pl/min to 11.70 ml/min (dual channel version) or 0.54 pl/min to 39.77 ml (single channel version).

The Pump 11 Pico Plus Elite is an Infusion/Withdrawal Programmable Syringe Pump available in single or dual syringe configurations. This pump has advanced connectivity with a footswitch, USB serial port for computer control, RS-485 (or optional RJ-II) ports for daisy chaining pumps and Digital I/O for remote control.

Item No.	Description
70-4506	Pump 11 Pico Plus Elite Infusion/Withdrawal Programmable Dual Syringe Pump
70-4511	Pump 11 Pico Plus Elite Infusion/Withdrawal Programmable Single Syringe

DETAILS

The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite is the lowest flow, highest accuracy pump with unparalleled ease of use with a high resolution touch screen with intuitive icon interface. It can deliver volumes down to 0.54 pl/min. This infusion/withdrawal dual syringe pump is ideal for applications such as microdialysis. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

Features

- New color LCD touch screen
- Intuitive icon interface
- Up-front control knobs for ease of operation
- Quick start methods
- Program simple to complex methods without a PC
- Relative time clock

- Vertical or horizontal orientation
- 35 lb linear force adjustable across the entire flow range
- Can daisy chain pumps
- CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Microfluidics
- Microdialysis
- Accurate delivery of coatings
- Reactor dosing
- Cell injections
- Fluid sampling
- High presure injection
- Low pressure chromatography
- Flow programming
- Binary gradients
- % composition step changes
- I/O interactive experiments

This syringe pump has a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5ul to 10 ml (dual channel version) or 0.5 ul to 60 ml (single channel version). The Pump 11 Pico Plus Elite offers enhanced flow performance with high accuracy and smooth flow from 0.54 pl/min to 11.70 ml/min (dual channel version) or 0.54 pl/min to 39.77 ml (single channel version).

The Pump 11 Pico Plus Elite is an Infusion/Withdrawal Programmable Syringe Pump available in single or dual syringe configurations. This pump has advanced connectivity with a footswitch, USB serial port for computer control, RS-485 (or optional RJ-11) ports for daisy chaining pumps and Digital I/O for remote control.

Since 1901 Harvard Apparatus has been supporting bioresearch fluidics requirements with the culmination being the introduction of the first commercial syringe pump for bioresearch in 1956. Since 1956, over 70,000 satisfied syringe pump users around the world have made Harvard Apparatus syringe pumps the worlds #1 choice.

The Pump 11 Pico Plus Elite is a low flow syringe pump designed for use in applications including: microdialysis, microfluidics, cellular injections and fluid sampling.

Program Description

To operate the Pump 11 Pico Plus Elite, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method.

Advanced Programming Features

- Constant Rate
- Ramp
- Gradients
- % composition (up to two solvents)
- Autofill
- I/O — dedicated and user defined I/O

Easy-to-Use Interface

The Pump 11 Pico Plus Elite color LCD touch screen graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary set up screens for the applications. From those screens you can access all the commands needed to operate the Pump 11 Elite, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main navigational branches, the quick start Methods, user-defined Methods, and system settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface. Advanced GLP Documentation Features:

- Download experimental parameter information to PC
- Alpha/numeric keypad for method naming

Accessories

A full range of accessories are compatible with the Pump 11 Pico Plus Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4506**	**70-4511**
Pump Configuration	Standard	Standard
Pump Function	Infusion/Withdrawal/Programmable	Infusion/Withdrawal/Programmable
Flow Rate Maximum	11.70 ml/min using 10 ml syringe	39.77 ml/min using 60 ml syringe
Flow Rate Minimum	0.54 pl/min using 0.5 Âµl syringe	0.54 pl/min using 0.5 Âµl syringe
Syringe Size Minimum	0.5 Âµl	0.5 Âµl
Syringe Size Maximum	10 ml	60 ml
Max Linear Force	35 lb @ 100% Force Selection	35 lb @ 100% Force Selection
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector
RS 232 Connectors	optional RJ-11	optional RJ-11
USB Connectors	Type B	Type B
Accuracy	Â±0.35%	Â±0.35%
Non Volatile Memory	Storage of all settings	Storage of all settings
Drive Motor	0.9Â° Stepper Motor	0.9Â° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Number of Microsteps per one rev of Lead Screw	20,480	20,480
Step Rate Minimum	27.5 sec/Âµstep	27.5 sec/Âµstep
Step Rate Maximum	26 Âµsec/Âµstep	26 Âµsec/Âµstep
Step Resolution	0.031 Âµm/Âµstep	0.031 Âµm/Âµstep

Specifications	70-4506	70-4511
Pusher Travel Rate Minimum	0.068 Âµm/min	0.068 Âµm/min
Pusher Travel Rate Maximum	71.55 mm/min	71.55 mm/min
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Input Power	12-30 VDC	12-30 VDC
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz
Dimensions, Control Box L x D x H	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Net Weight	4.6 lb (2.1 kg)	
Environmental Operating Temperature	40Â°F to 104Â°F (4Â°C to 40Â°C)	40Â°F to 104Â°F (Â°C to 40Â°C)
Environmental Storage Temperature	14Â°F to 158Â°F (-10Â°C to 70Â°C)	14Â°F to 158Â°F (-10Â°C to 70Â°C)
Environmental 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
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS

Standard Infuse/Withdraw PHD ULTRA™ 4400 Programmable Syringe Pump

The PHD ULTRA™ 4400 is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ 4400 will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ 4400 the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC
- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
a. Configurations: standard and remote
b. Connectivity: RS-232 and USB for PC Control; RS-485 for daisy chaining

Item No.	Description
70-3010	PHD ULTRA™ 4400 Syringe Pump Infuse/Withdraw Programmable
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)

Item No.	Description
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ 4400 is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

Features

- Superior drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 200 lbs across the entire flow range
- Daisy chain
- Remote configuration placement
- CE, ETL (UL, CSA), WEEE, EU RoHS, & CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electrospinning
- Reaction chamber addition
- Viscous Solutions
- High Pressure Injection
- Highly Corrosive Fluids
- Fluid Blending
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

The PHD ULTRA™ 4400 will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA the new standard for syringe pumps:

1. Superior pending mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC
- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
- Configurations: standard and remote
- Connectivity: RS-232 and USB for PC Control; RS-485 for daisy chaining

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Program Description

To operate the PHD ULTRA™ 4400, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming—change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O—dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Highest Accuracy and Precision

The PHD ULTRA™ 4400 syringe pump family has a new patent pending fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.35% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.35% and reproducibility within 0.05%. A Single syringe from 0.5 µl to 140 ml pumps at a range of 3.06 pl/min to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ 4400 features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 1 syringe.

Easy-to-Use Interface

The PHD ULTRA™ 4400; color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™ 4400 as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- Animal Infusions or Withdrawals—the PHD ULTRA™ 4400 will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

The PHD ULTRA™ 4400 Syringe Pump is available as an Infuse/Withdraw Programmable model. This model supports both infusion and withdrawal operations and can use both simplified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the PHD ULTRA™ 4400, this model also allows users to create and store multiple user-defined methods on the pump.

Accessories

A full range of accessories are compatible with the PHD ULTRA™ 4400 including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-3010**
Accuracy	±0.35%
Classification	Class I
Dimensions, L x D x H	12 x 8.5 x 7.25 in (30.48 x 21.59 x 18.4 cm)
Display	4.3" WQVGA TFT Color Display with Touch
Drive Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	216 ml/min using a 140 ml syringe
Flow Rate Minimum	3.06 pl/min using a 0.5 µl syringe
I O TTL Connectors	15-pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	200 lb @ 100% Force Selection

Specifications	70-3010
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight	12.1 lb (5.5 kg)
No of Syringes	1
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	6,400
Pollution Degree	1
Pump Configuration	Standard
Pump Function	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	190.8 mm/min
Pusher Travel Rate Minimum	0.36 µm/min
RS dash 232 Connectors	9 pin D-Sub Connector
Rack Type	Standard Rack
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme
Step Rate Maximum	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100–240 VAC, 50/60 Hz
RS - 232 Connectors	IEEE-1394, 6pos

Remote Infuse/Withdraw PHD ULTRA™ HPSI & PHD ULTRA™ XF Programmable Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

Remote Pump Model

The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30-foot RS-485 (IEEE-1394) cable. This makes the pump ideal for use in hazardous environments where the researcher is safer distanced from the material being pumped or for applications where you need to have the pumping mechanism inside a chamber. Every version of the PHD ULTRA™ is available in a remote model.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump.

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only).
- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
- Configurations: push-pull, standard, remote, high pressure, multi racks
- Connectivity: RS 232 and USB for PC; RS 485 for daisy chain

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)

Item No.	Description
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

Features

- New patent pending drive mechanism for unmatched smooth flow, accuracy and precision
- High capacity - up to 800 ml with four 200 ml syringes
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 433 or 1000 lbs (depending upon model) across the entire flow range
- Daisy chain
- Remote configuration placement
- CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme Approved
- 2-year warranty

Applications

- Drug/Nutritional infusions
- Reaction chamber addition
- High pressure injection
- Highly corrosive fluids
- Remote pumping of hazardous material
- Continuous flow
- Flow programming
- Viscous solutions
- Large flow deliveries
- I/O interactive experiments

Remote Pump Model

The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30 foot RS-485 (IEEE-1394) cable. This makes the pump ideal for use in hazardous environments where the researcher is safer distanced from the material being pumped or for applications where you need to have the pumping mechanism inside a chamber. Every version of the PHD ULTRA™ is available in a remote model.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)
- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
- Configurations: push-pull, standard, remote, high pressure, multi racks
- Connectivity: RS 232 and USB for PC; RS 485 for daisy chain

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Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming—change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O — dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle

stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- Animal Infusions or Withdrawals—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.

- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	70-3311	70-3312	70-3314
Accuracy	±0.50%	±0.50%	±0.50%
Classification	Class I	Class I	Class I
Dimensions,Control Box L x D x H	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)		
Dimensions, Remote Box L x D x H	16.0 x 12.0 x 7.75 in (40.64 x 30.48 x 19.69 cm)	16.0 x 12.0 x 7.75 in (40.64 x 30.48 x 19.69 cm)	
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	1.8° Geared Stepper Motor	1.8° Geared Stepper Motor	1.8° Geared Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)	
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)

Specifications	70-3311	70-3312	70-3314
Flow Rate Maximum	144.1 ml/min using 200 ml syringe	106.1 ml/min using 140 ml syringe	144.1 ml/min using 200 ml syringe
Flow Rate Minimum	50.7 nl/min using 20 ml syringe	50.7 nl/min using 20 ml syringe	50.7 nl/min using 20 ml syringe
I O TTL Connectors	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector
Input Power	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse
Installation Category	II	II	II
Max Linear Force	433 lb @ 100% Force Selection	433 lb @ 100% Force Selection	1000 lb @ 100% Force Selection
Mode of Operation	Continuous	Continuous	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	30.2 lb (3.7 kg)	30.2 lb (13.7 kg)	44 lb (20 kg)
No of Syringes	4	10	4
Non Volatile Memory	Storage of all settings	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	32,000	32,000	32,000
Pollution Degree	1	1	1
Pump Configuration	Remote	Remote	Remote
Pump Function	Infuse/Withdraw, Programmable	Infuse/Withdraw, Programmable	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	91.5 mm/min	91.5 mm/min	91.5 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min	0.18 µm/min
RS 232 Connectors	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme
Step Rate Maximum	52 µsec/µstep	52 µsec/µstep	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Syringe Rack Type	Standard Rack	Feeding Station Rack	Standard Rack
Syringe Size Maximum	200 ml	140 ml	200 ml

Specifications	70-3311	70-3312	70-3314
Syringe Size Minimum	20 ml	60 ml	20 ml
USB Connectors	Type B	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Remote Infuse/Withdraw PHD ULTRA™ 4400 Programmable Syringe Pumps

The PHD ULTRA™ 4400 is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ 4400 will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ 4400 the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC
- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
- Configurations: standard and remote
- Connectivity: RS-232 and USB for PC Control; RS-485 for daisy chaining

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ 4400 is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

Features

- Superior drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC

- Real and relative time clocks
- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 200 lbs across the entire flow range
- Daisy chain
- Remote configuration placement
- CE, ETL (UL, CSA), WEEE, EU RoHS, & CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electrospinning
- Reaction chamber addition
- Viscous Solutions
- High Pressure Injection
- Highly Corrosive Fluids
- Fluid Blending
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

The PHD ULTRA™ 4400 will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA the new standard for syringe pumps:

1. Superior pending mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC
- Preprogrammed methods for simple to complex operations that allow you to be up and running with

the push of a button
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
- Configurations: standard and remote
- Connectivity: RS-232 and USB for PC Control; RS-485 for daisy chaining

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Program Description

To operate the PHD ULTRA™ 4400, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming—change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O—dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Highest Accuracy and Precision

The PHD ULTRA™ 4400 syringe pump family has a new patent pending fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.35% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.35% and reproducibility within 0.05%. A Single syringe from 0.5 µl to 140 ml pumps at a range of 3.06 pl/min to 216 ml/min. Maximum Experimental Versatility The PHD ULTRA™ 4400 features true Multi-Pump Operation. The pump can be oriented vertically

or horizontally for optimum experimental connectivity. This pump comes standard to hold 1 syringe.

Easy-to-Use Interface

The PHD ULTRA™ 4400; color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™ 4400 as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- Animal Infusions or Withdrawals—the PHD ULTRA™ 4400 will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

The PHD ULTRA™ 4400 Syringe Pump is available as an Infuse/Withdraw Programmable model. This model supports both infusion and withdrawal operations and can use both simplified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the PHD ULTRA™ 4400, this model also allows users to create and store multiple user-defined methods on the pump.

Accessories

A full range of accessories are compatible with the PHD ULTRA™ 4400 including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	70-3310
Accuracy	±0.35%
Classification	Class I
Dimensions, Control Box, L x D x H	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)
Dimensions, Remote Box, L x D x H	11.0 x 5.3 x 7.25 in (27.94 x 13.46 x 18.42 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	216 ml/min using 140 ml syringe
Flow Rate Minimum	3.06 pl/min using 0.5 µl syringe
I/O & TTL Connectors	15-pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	200 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight	15.9 lb (7.2 kg)
No of Syringes	1

Specifications **70-3310**

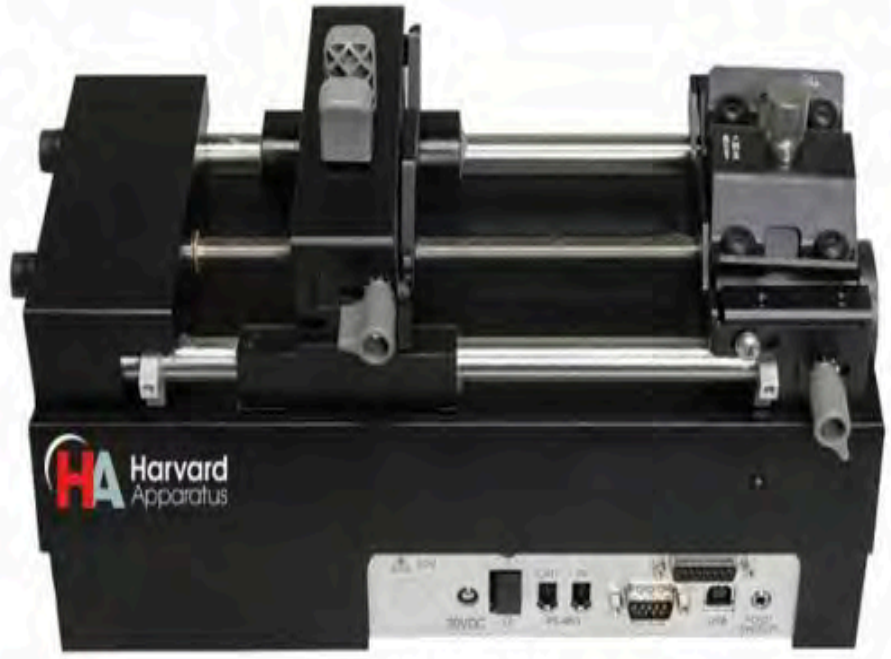
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	6,400
Pollution Degree	1
Pump Configuration	Remote
Pump Function	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	190.8 mm/min
Pusher Travel Rate Minimum	0.36 µm/min
RS 232 Connectors	9 pin D-Sub Connector
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz

PHD ULTRA OEM Syringe Pump Modules

The PHD ULTRA™ Syringe Pump Modules are infusion/ withdrawal pumps. They are available in three configurations: standard, push/pull and high force. These modules include a footswitch input, USB, RS-232, RS-485 and I/O connectors. They can be controlled via PC. You can also start and stop a pump using the 15-pin user I/O connector.

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users. This syringe pump platform has superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump.

Item No.	Description
70-3506	PHD ULTRA™ Syringe Pump Module with Power Supply
70-3508	PHD ULTRA™ Push/Pull Syringe Pump Module with Power Supply
70-3510	PHD ULTRA™ 4400 Syringe Pump Module with Power Supply
70-3514	PHD ULTRA™ XF Syringe Pump Module with Power Supply



70-3506

DETAILS

PHD ULTRA™ Syringe Pump Modules The PHD ULTRA™ Syringe Pump Modules are infusion/ withdrawal pumps. They are available in three configurations: standard, push/pull and high force. These modules include a footswitch input, USB, RS-232, RS-485 and I/O connectors. They can be controlled via PC. You can also start and stop a pump using the 15-pin user I/O connector.

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users. This syringe pump platform has superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump.

SPECIFICATIONS

Specifications	70-3506	70-3508	70-3510	70-3514
Accuracy	±0.25%	±0.25%	±0.35%	±0.5%
Classification	Class I	Class I	Class I	Class I

Specifications	70-3506	70-3508	70-3510	70-3514
Dimensions Control Box L x D x H	11.75 x 5.5 x 6.5 in (29.8 x 14 x 16.75 cm)	11.75 x 5.5 x 6.5 in (29.8 x 14 x 16.75 cm)	11.75 x 5.5 x 6.5 in (29.8 x 14 x 16.75 cm)	
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor	1.8° Stepper Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F*(4°C to 40°C*)	40°F to 104°F* (4°C to 40°C*)	40°F to 104°F* (4°C to 40°C*)	
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)			
Flow Rate Maximum	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe	144.08 ml/min using 200 ml syringe
Flow Rate Minimum	1.56 pl/min using 0.5 µl syringe	1.56 pl/min using 0.5 µl syringe	1.56 pl/min using 0.5 µl syringe	50.7 nl/min using 20 ml syringe
I/O & TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector	15 pin D-Sub Connector	15 pin D-Sub Connector
Input Power	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse
Installation Category	II	II	II	II
Max Linear Force	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	200 lb @ 100% Force Selection	1000 lb @ 100% Force Selection
Mode of Operation	Continuous	Continuous	Continuous	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	10 lb (4.5 kg)	11.2 lb (5.1 kg)	11.7 lb (5.3 kg)	10 lb (4.5 kg)
No of Syringes	2	4	1	4
Non Volatile Memory	Storage of all settings	Storage of all settings	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800	12,800	6,400	12,800
Pollution Degree	1	1	1	1

Specifications	70-3506	70-3508	70-3510	70-3514
Pump Configuration	Standard	Standard	Standard	Standard
Pump Function	Infuse/Withdraw	Push/Pull	Infuse/Withdraw	Infuse/Withdraw
Pusher Travel Rate Maximum	190.8 mm/min	190.8 mm/min	190.8 mm/min	91.637 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min	0.36 µm/min	0.18 µm/min
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Syringe Rack Type	Standard Rack	Standard Rack	Standard Rack	Standard Rack
Syringe Size Maximum	140 ml	140 ml	140 ml	200 ml
Syringe Size Minimum	0.5 µl	0.5 µl	0.5 µl	20 ml
USB Connectors	Type B	Type B	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz
RS 232 Connectors	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector

Satellite Infuse/Withdraw PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ Satellite Pumps are infusion/withdrawal pumps. They are available in three configurations: standard, push/pull and high force (PHD ULTRA™ 4400 Satellite). The Satellite Pumps are combined with stand alone PHD ULTRA™ Pumps to create a Gradient System. Satellite Pumps can only be powered from a stand alone PHD ULTRA™ via RS-485. They cannot be controlled with a PC (Please see our PHD ULTRA OEM pumps for PC controlled modules). Satellite Pumps include a footswitch input, USB and RS-485 connectors.

Item No.	Description
70-3406	PHD ULTRA™ Satellite Syringe Pump Infuse/Withdraw
70-3408	PHD ULTRA™ Satellite Syringe Pump Infuse/Withdraw with Push/Pull Mechanism
70-3410	PHD ULTRA™ 4400 Satellite Syringe Pump Infuse/Withdraw

DETAILS

The PHD ULTRA™ Satellite Pumps are infusion/withdrawal pumps. They are available in three configurations: standard, push/pull and high force (PHD ULTRA™ 4400 Satellite). The Satellite Pumps are combined with stand alone PHD ULTRA™ Pumps to create a Gradient System. Satellite Pumps can only be powered from a stand alone PHD ULTRA™ via RSâ€485. They cannot be controlled with a PC (Please see our PHD ULTRA OEM pumps for PC controlled modules). Satellite Pumps include a footswitch input, USB and RSâ€485 connectors.

SPECIFICATIONS

Specifications	70-3406	70-3408	70-3410
Accuracy	±0.25%	±0.25%	±0.35%
Classification	Class I	Class I	Class I

Specifications	70-3406	70-3408	70-3410
Dimensions L x D x H	11.75 x 5.5 x 6.5 in (29.8 x 14.0 x 16.5 cm)		
Display	N/A	N/A	N/A
Drive Motor	1.8° Stepper Motor	1.8° Stepper Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	215.8 ml/min using a 140 ml syringe	215.8 ml/min using a 140 ml syringe	215.8 ml/min using a 140 ml syringe
Flow Rate Minimum	3.06 pl/min using a 0.5 µl syringe	3.06 pl/min using a 0.5 µl syringe	3.06 pl/min using a 0.5 µl syringe
I/O TTL Connectors	15-pin D-sub Connector	15-pin D-sub Connector	15-pin D-sub Connector
Input Power	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse
Installation Category	Continuous	Continuous	Continuous
Max Linear Force	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	200 lb @ 100% Force Selection
Mode of Operation	-10°C to 70°C	-10°C to 70°C	-10°C to 70°C
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	11.7 lb (5.3 kg)	11.7 lb (5.3 kg)	11.7 lb (5.3 kg)
No of Syringes	2	4	1
Non Volatile Memory	Storage of all settings	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800	12,800	6,400
Pollution Degree	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Pump Configuration	Satellite	Satellite	Satellite
Pump Function	Infuse/Withdraw	Push/Pull	Infuse/Withdraw

Specifications	70-3406	70-3408	70-3410
Pusher Travel Rate Maximum	190.8 mm/min	190.8 mm/min	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min	0.36 µm/min
RS-232 Connectors	N/A	N/A	N/A
Rack Type	Standard	Push/Pull	Standard
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS and CB Scheme
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Syringe Size Maximum	140 ml	140 ml	140 ml
Syringe Size Minimum	0.5 µl	0.5 µl	0.5 µl
USB Connectors	Type B	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Standard Infusion Only Pump 11 Elite Syringe Pumps

The Pump 11 Elite Series of syringe pumps expands its capabilities to satisfy your experimental requirements. These compact syringe pumps carry on the tradition as the premiere workhorse infusion pump, offering unparalleled ease of use with a high resolution touch screen with intuitive icon interface.

These innovative syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 ul to 60 ml (single syringe) and 0.5 ul to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Infusion Only Models are available in single or dual syringe rack configurations. These pumps have advanced connectivity with a USB serial port for computer control and footswitch connection for stop/start control (footswitch sold separately).

Item No.	Description
70-4500	Pump 11 Elite Infusion Only Single Syringe
70-4501	Pump 11 Elite Infusion Only Dual Syringe

DETAILS

The Pump 11 Elite Series is a family of accurate, low flow syringe pumps designed for use in applications including: mass spec calibration, drug and nutritional studies, reactor dosing, and electro-spinning.

These innovative syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 60 ml (single syringe) and 0.5 µl to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Infusion Only Models are available in single or dual syringe rack configurations. These pumps have advanced connectivity with a USB serial port for computer control and footswitch connection for stop/start control (footswitch sold separately). The infusion Only (single and dual syringe models) support infusion operations at user-defined flow rates and with selectable target volume or time values to control the total infusion volume. The Infusion Only models do not include programmable, user-defined methods. (Infusion/Withdrawal Programmable models are also available)

Easy-to-Use Interface

The Pump 11 Elite color LCD touch screen with graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Quick Start infusion screen is the primary "home" for the pumps. From that screen you can access all the commands needed to operate the Pump 11 Elite, as well as access the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

You can control operations directly with the touch screen or remotely from an independent computer or device via the external footswitch interface.

Accessories

A full range of accessories are compatible with the Pump 11 Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4500**	**70-4501**
Accuracy	±0.5%	±0.5%
Classification	Class I	Class I
Dimensions Control Box	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)
Flow Rate Maximum	88.28 ml/min using 60 ml syringe	31.97 ml/min using 10 ml syringe
Flow Rate Minimum	1.28 pl/min using 0.5 µl syringe	1.28 pl/min using 0.5 µl syringe
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector

Specifications	70-4500	70-4501
Input Power	12-30 VDC	12-30 VDC
Installation Category	II	II
Max Linear Force	35 lb @ 100% Force Selection	35 lb @ 100% Force Selection
Mode of Operation	Continuous	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	4.6 lb (2.1 kg)	4.6 lb (2.1 kg)
No of Syringes	1	2
Non Volatile Memory	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	15,360	15,360
Pollution Degree	1	1
Pump Configuration	Standard	Standard
Pump Function	Infusion Only	Infusion Only
Pusher Travel Rate Maximum	159.8 mm/min	159.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min
RS 232 Connectors	optional RJ-11	optional RJ-11
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep
Syringe Size Maximum	60 ml	10 ml
Syringe Size Minimum	0.5 µl	0.5 µl
USB Connectors	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Standard Infusion Only PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks
- Connectivity: RS-232 and USB for PC; RS-485 for daisy chain

Item No.	Description
70-3005	PHD ULTRA™ Syringe Pump Infuse Only Standard
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks

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Features

- New patent pending drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range
- Daisy chain
- Remote configuration available
- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning

- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming - Change the flow with time, volume or a triggered event as many times as you like
- Bolus - Inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery - Calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio - up to three solvents

- I/O — dedicated and user defined I/O
- Pulsed Flow- so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140 ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- **Animal Infusions or Withdrawals**—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- **Proportioning and Delivering of Mixtures**—mixing gradients or proportions with independent control of two liquids.
- **Aerosol for Coating**—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.

- **Delivery to Mass Spectroscopy**—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- **Compensating Flows**—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- **Dispensers/Injectors**—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

The PHD ULTRA™ Syringe Pump is available in three configurations designed for different operating environments and varying degrees of operational flexibility.

Infuse Only: This model supports infusion operations at user-definable flow rates and with selectable target volume or time values to control the total infusion volume. The entry-level Infuse Only model does not include programmable, user-defined methods.

Infuse/Withdraw: This model supports infusion and withdraw operations at user-definable flow rates and with selectable target volumes or time values to control the total volume pumped for both the infusion and withdraw portions of a procedure. This model provides access to many of the advanced method programming options of the PHD ULTRA™, but only supports a single stored method.

Infuse/Withdraw Programmable: This model supports both infusion and withdraw operations and can use both simplified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the PHD ULTRA™, this model also allows users to create and store multiple user-defined methods on the pump.

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, in-line heaters and coolers, nanofluidic circuits, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	70-3005
Accuracy	±0.25%
Classification	Class I
Dimensions **L x D x H**	12.0 x 8.5 x 7.25 in (30.48 x 21.59 x 18.42 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F(-10°C to 70°C)
Flow Rate Maximum	216 ml/min using 140 ml syringe
Flow Rate Minimum	1.5 pl/min using 0.5 µl syringe
I/O & TTL Connectors	15 pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	75 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight	10 lb (4.5 kg)
No of Syringes	2
Non Volatile Memory	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800
Pollution Degree	1
Pump Configuration	Standard
Pump Function	Infusion Only
Pusher Travel Rate Maximum	190.8 mm/min

Specifications	70-3005
Pusher Travel Rate Minimum	0.18 µm/min
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS
Step Rate Maximum	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz
RS-232Connectors	9-pin D-Sub Connector

Standard Infuse/Withdraw Pump 11 Elite Programmable Syringe Pumps

The Pump 11 Elite Series of syringe pumps expands its capabilities to satisfy your experimental requirements. These compact syringe pumps carry on the tradition as the premiere workhorse infusion pump, offering unparalleled ease of use with a high resolution touch screen with intuitive icon interface. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

These syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 60 ml (single syringe) and 0.5 µl to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Series is available in Infusion Only or Infusion/Withdrawal Programmable Models with single or dual syringe racks. These pumps have advanced connectivity with a USB serial port for computer control, RS-485 (or optional RJ-II) ports for daisy chaining pumps and Digital I/O for remote control.

Item No.	Description
70-4504	Pump 11 Elite Infusion/Withdrawal Programmable Single Syringe
70-4505	Pump 11 Elite Infusion/Withdrawal Programmable Dual Syringe

DETAILS

The Pump 11 Elite Series is a family of accurate, low flow syringe pumps designed for use in applications including: mass spec calibration, drug and nutritional studies, reactor dosing, and electrospinning.

The Pump 11 Elite Series of syringe pumps expands its capabilities to satisfy your experimental requirements. These compact syringe pumps carry on the tradition as the premiere workhorse infusion pump, offering unparalleled ease of use with a high resolution touch screen with intuitive icon interface. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

These syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 60 ml (single syringe) and 0.5 µl to 10 ml (dual syringe). The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min.

The Pump 11 Elite Series is available in Infusion Only or Infusion/Withdrawal Programmable Models with single or dual syringe racks. These pumps have advanced connectivity with a USB serial port for computer control, RS-485 (or optional RJ-11) ports for daisy chaining pumps and Digital I/O for remote control.

Features

- New color LCD touch screen
- Intuitive icon interface
- Up-front control knobs for ease of operation
- Quick start methods
- Program simple to complex methods without a PC
- Relative time clock
- Vertical or horizontal orientation
- 35 lb linear force adjustable across the entire flow range
- Can daisy chain pumps
- CE, CSA, UL, WEEE, EU RoHS, CB Scheme Approved
- 2-year warranty

Applications

- Nanofluidics
- Microfluidics
- Drug/Nutritional studies
- Electrospinning
- Reactor dosing
- Cell injections
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Flow programming
- Binary gradients
- % composition step changes
- I/O interactive experiments

Program Description

To operate the Pump 11 Elite, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

Select a method

Enter operating parameters

Preview your method

Run your method

Advanced Programming Features

- Constant Rate Ramp
- Gradients
- % composition (up to two solvents)
- Autofill
- I/O — dedicated and user defined I/O

Easy-to-Use Interface

The Pump 11 Elite color LCD touch screen with graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Method Main or Quick Start screens are the primary "home" for the pumps. From those screens you can access all the commands needed to operate the Pump 11 Elite, as well as access the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main navigational branches, the quick start Methods, user-defined Methods, and system settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Advanced GLP Documentation Features

- Download experimental parameter information to PC
- Alpha/numeric keypad for method naming

Pump Models

The 11 Elite Syringe Pumps are available in two configurations designed for different operating environments and varying degrees of operational flexibility.

Infusion Only (single and dual syringe models): These models support infusion operations at user-defined flow rates and with selectable target volume or time values to control the total infusion

volume. The Infusion Only models do not include programmable, user-defined methods.

Infusion/Withdrawal Programmable (single and dual syringe models): The models support both infusion and withdrawal operations and can use both simplified pumping profiles or the more advanced pumping profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the Pump 11 Elite, this model also allows users to create and store up to two user-defined methods of 50 steps each on the pump.

Accessories

A full range of accessories are compatible with the Pump 11 Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4504**	**70-4505**
Accuracy	±0.5%	±0.5%
Syringes	1	2
Flow Rate Minimum	1.26 pl/min	1.26 pl/min
Flow Rate Maximum	88.4 ml/min	26.02 ml/min
Classification	Class I	Class I
Dimensions, Control Box L x D x H	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Dimensions, Remote Box L x D x H	N/A	
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F(-10°C to 70°C)	14°F to 158°F (-10°C to 70°C)
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector
Input Power	12-30 VDC	12-30 VDC

Specifications	70-4504	70-4505
Installation Category	II	II
Max Linear Force	35 lb at 100% Force	35 lbs at 100% Force
Mode of Operation	Glucose Clamp	Glucose Clamp
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	4.6 lb (2.1 kg)	4.6 lb (2.1 kg)
No of Syringes	1	2
Non Volatile Memory	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	15,360	15,360
Pollution Degree	1	1
Pump Configuration	Single	Dual
Pump Function	Infuse/Withdraw, Programmable	Infuse/Withdraw, Programmable
Pusher Travel Rate Maximum	159.8 mm/min	159.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min
Regulatory Certifications	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme	CE, ETL (UL, CSA), WEEE, EU RoHS, CB Scheme
Step Rate Maximum	26 µsec/	26 µsec/
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep
Syringe Size Maximum	60 ml	10 ml
Syringe Size Minimum	0.5 µl	0.5 µl
USB Connectors	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Pump 33 DDS (Dual Drive System) Syringe Pump

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a leap forward in syringe pump capability. The Pump 33 DDS has two independent pumping channels controlled by an intuitive touch screen interface.

This multi-purpose syringe pump employs advanced syringe mechanisms that include a tight gripping, extremely secure syringe clamp that accommodates syringe sizes 0.5 µl to 60 ml. The Pump 33 DDS offers enhanced flow performance with high accuracy and smooth flow from 1.02 pl/min to 106 ml/min.

The new Harvard Apparatus Pump 33 DDS employs a graphical user interface controlled with a large 7" LCD Color Touchscreen.

Syringe tables containing all major syringe manufacturers allow simple selection of any compatible syringe size.

Audible Alarms, Adjustable Force and Screen Lock are all features that are available with the touch of the screen.

Features Include:

- Two Independently Controlled pumping channels in one instrument
- Run two separate flows using different directions, flow rates, volumes and syringe sizes
- Intuitive Icon Based Graphical User Interface controlled with a 7" LCD Color Touch Screen Display
- Accommodates Syringe Sizes 0.5 µl to 60 ml
- Smooth flow down to 1.02 pl/min
- High accuracy ± 0.25%
- USB, RS-232 & TTL Connectivity

Item No.	Description
70-3333	Pump 33 DDS (Dual Drive System) Syringe Pump
70-2215	Footswitch (w/ Phono Plug)
70-3340	RS-232 Cable for Pump 33 DDS

DETAILS

The Harvard Apparatus Pump 33 DDS (Dual Drive System) is a leap forward in syringe pump capability.

The Pump 33 DDS has two independent pumping channels controlled by an intuitive touch screen interface. This multi-purpose syringe pump employs advanced syringe mechanisms that include a tight gripping, extremely secure syringe clamp that accommodates syringe sizes 0.5 µl to 60 ml. The Pump 33 DDS offers enhanced flow performance with high accuracy and smooth flow from 1.02 pl/min to 106 ml/min.

This new syringe pump employs a graphical user interface controlled with a large 7" LCD color touch screen for quick and easy syringe pump setup. Syringe tables containing all major syringe manufacturers allow simple selection of any compatible syringe size. Audible Alarms, Adjustable Force and Screen Lock are all features that are available with the touch of the screen.

The bright informative display run screen presents the user with all key dispensing parameters in real time.

Features

- Two Independently Controlled pumping channels in one instrument

- Run two separate flows using different directions, flow rates, volumes and syringe sizes
- Intuitive Icon Based Graphical User Interface controlled with a 7” LCD Color Touch Screen Display
- Accommodates Syringe Sizes 0.5 µl to 60 ml
- Smooth flow down to 1.02 pl/min
- High accuracy ± 0.25%
- USB, RS-232 & TTL Connectivity

Operating Conditions

Three operating conditions are available to accommodate a wide range of setups and experimental protocols.

Independent Condition

Independent Condition allows the Pump 33 DDS to operate as two separate syringe pumps named P1 & P2. P1 is syringe position 1, closest to the touch screen interface and P1 is syringe position 2 and is toward the backside of the unit. Each syringe will operate independently with different syringe types, size, force, target (volume or time) and flow rate settings. This innovative condition allows you to run two different flows at the same time using one instrument.

Reciprocating Condition

In reciprocating condition, both syringe channels move in opposite directions at the same rate using the same syringe size and type. When combined with a valve box, the reciprocating condition can provide the continuous fluidic delivery of a peristaltic pump with the accurate pulse free low flow rates provided by a syringe pump.

Twin Condition

The Twin Condition allows both syringes to operate in the same mode using the exact same syringe type, syringe size, force, target (volume or time) and flow rate settings. The pump also allows the user to combine both flows for higher speed and volume infusion applications.

Advanced Connectivity

The Pump 33 DDS comes standard with USB and RS-232 for PC communication and RS-485 for pump-to-pump communication. An entire suite of ASCII commands is available to control the pump remotely with a PC. The pump contains a footswitch input and digital input/output for each independent pumping channel.

Accessories

A full range of accessories are compatible with the Pump 33 DDS (Dual Drive System) Syringe Pump including syringes, connectors, tubing and valve boxes.

SPECIFICATIONS

UNIT SPECIFICATION	PARAMETER
Accuracy	± 0.25 %
Linear Force (Max, per syringe)	70 lb (31.75 kg) at 100% Force Setting up to a flow rate of 90 ml/min using up to a 60 ml syringe with a 32.573 mm inner diameter. 50 lb (22.6 kg) at 100% Force Setting for flow rates 90 ml/min to 106 ml/min using the same size syringe.
Syringe Size:	Two Independent syringe mechanisms (noted as syringe drive P1 & P2)
Minimum	0.5 µl (0.103 mm minimum inner diameter)
Maximum	60 ml (32.573 mm maximum inner diameter)*
Flow Rate:	
Minimum	1.02 pl/min (0.5 ul syringe, 0.103 mm inner diameter)
Maximum	106 ml/min (60 ml syringe, 32.573 mm diameter)
Display	7" WQVGA TFT Color Display with Touch Screen
Modes of Operation:	
Twin Condition	Both syringes of the same size operate identically (flow rate, direction & volume)
Independent Condition	Both syringes operate independently
Reciprocating Condition	Continuous flow, both syringes of the same size operate identically in opposite directions
Non-Volatile Memory	Stores all settings
Pump Command Control	ASCII Command Set
Real time Clock	Yes, with battery backup (battery included and required for real time clock)
Connectors:	
Power	Barrel connector, (-) barrel (+) post 2 mm X 5 mm male plug
RS-485	IEEE-1394, 6 pos (Pump-to-pump communication only)

USB	Type B
RS-232	9 pin D-Sub Connector
(I/O) TTL	15-pin D-sub connector (one for each axis)
Footswitch Connections	Mini phono jack
Drive Motor	Two independent stepper motors
Motor Drive Control	MCU controlled
Step Rate:	
Minimum	27 sec/µstep
Maximum	26 µsec/µstep
Stall Detection	Yes, independent axis stall detection
Input Power	30 V, 2.0 A
Power Supply	Input 100 to 240 VAC, 50/60 Hz, Output 30 V 2.0 A, 50 Watts
Dimensions (L x D x H)	11 x 15 x 8 in (28 cm x 39 cm x 21 cm)
Weight	21 lb (9.09 kg)
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Operating Humidity	80% @ 25° C ambient temperature
Storage Humidity	20% to 80% RH, non-condensing
Classification	Class I
Pollution	Degree 1
Installation	Category II
Regulatory Certifications	CE, ETL (UL & CSA), CB Scheme, EU RoHS, WEEE
*NOTE: Some larger syringes may be compatible with the Pump 33 DDS. Please contact Technical Support for more information.	

Standard PHD ULTRA™ CP 4400 Syringe Pump

The PHD ULTRA™ CP Syringe Pump is the first of its kind to allow operation under constant pressure or constant flow. Historically, the only means available to dispense at constant pressure has involved the use of various amplifiers and other accessories/software. The PHD ULTRA™ CP Syringe Pump, when combined with virtually any commercially available pressure transducer/amplifier combination with 0 to 10 VDC analog output, results in a constant pressure dispensing system. This system can deliver fluids with an applied force up to 1,000 lb (depending upon the pump).

Using Harvard Apparatus syringe pump technology and software-controlled pressure monitoring, the PHD ULTRA™ CP Syringe Pump is able to maintain a user-defined system pressure ±2%. A user-adjustable sensitivity setting allows for the customization of the system response time necessary to attain the set pressure. The PHD ULTRA™ CP Syringe Pump allows the user to set pressures in the units of their choice including mmHg, kPa, and psi.

Item No.	Description
88-3016	PHD ULTRA™ CP 4400 Syringe Pump Infuse/Withdraw Programmable

DETAILS

The PHD ULTRA™ CP Syringe Pump is the first of its kind to allow operation under constant pressure or constant flow. Historically, the only means available to dispense at constant pressure has involved the use of various amplifiers and other accessories/software. The PHD ULTRA™ CP, when combined with virtually any commercially available pressure transducer/amplifier combination with 0 to 10 VDC analog output, results in a constant pressure dispensing system. This system can deliver fluids with an applied force up to 1,000 lb (depending upon the pump).

Features

- Enables continuous pressure-controlled infusion
- Use in constant flow or constant pressure mode
- Enhances safety for sensitive infusion targets and physiological experimentation
- Compatible with a wide range of pressure transducers
- Automatically adjusts flow rate to maintain constant pressure
- Alpha/numeric keyboard without a PC

- Icon operation
- New color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 200 lbs across the entire flow range
- CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme Approved
- 2-year warranty

Applications

- Short-term organ perfusion studies that require the maintenance of physiologic conditions.
- Introduction of chemical reactants in a controlled manner.
- Ocular injections and perfusions.
- Small animal whole-body perfusions.
- Constant pressure microfluidic mixing.
- Administration of genetic material into organs without viral vectors.

Superior Functionality

Using Harvard Apparatus syringe pump technology and software-controlled pressure monitoring, the PHD ULTRA™ CP Syringe Pump is able to maintain a user-defined system pressure ±2%.

A user-adjustable sensitivity setting allows for the customization of the system response time necessary to attain the set pressure. The PHD ULTRA™ CP Syringe Pump allows the user to set pressures in the units of their choice including mmHg, kPa, and psi.

Essential Application Tools

The PHD ULTRA™ CP Syringe Pump can work with any pressure transducer and amplifier that will output a 0-10V or similar signal. We offer a wide variety of pressure transducers and amplifiers to suit your particular application. Our most popular physiological pressure transducer is our APT-300, a fluid-filled unit with a pressure range of ±300 mmHg and a sensitivity of 5 µV/V/mmHg (±1%). This has an easily replaceable transducer head. For low pressure applications, such as maintaining the pressure in an eye, we have the P75 Venous Pressure Transducer. This pressure transducer has a pressure range of ñ75 mmHg and a sensitivity of 1 mV/mmHg. When the customer requires a separate amplifier, the unit of choice is the model 601 Transducer AmplifierModule, or TAM-A. As a PLUGSYS module, this DC Bridge Amplifier requires the use of a PLUGSYS housing with a power supply. Cases holding 2, 5, or 10 modules are available.

Pressure & Flow Rate Data

Data can be monitored via RS-232 from the PHD ULTRA™ CP Syringe Pump to a PC. In practice, the 0 to 10 V analog output of a pressure transducer amplifier is connected to the analog input on the rear panel of the pump. The amplifier or signal conditioner can be provided by the customer, or accomplished with various tranducers and amplifiers available from Harvard Apparatus. The pressure range may be scaled to fit the available transducer voltage output for systems that output less than 10 V. While in constant pressure mode, in addition to the set and actual pressure, the pump displays the flow rate. This data may be output for further analysis with a variety of data acquisition packages.

Accuracy & Reproducibility

In addition to constant pressure mode, the PHD ULTRA™ CP may also be used in flow mode with its worldrenowned accuracy and reproducibility.
All PHD ULTRA™ CP Syringe Pumps are infuse/withdraw programmable models. When used in flow mode, these offer programmable features such as method storage and flow programming functions to allow the user to create simple to complex methods. The PHD ULTRA™ CP Syringe Pump is available in a variety of configurations to suit the desired pressure or flow rate ranges.

Program Description

To operate the PHD ULTRA™ the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming—change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O—dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.35% and reproducibility within 0.05%. One syringe from 0.5 µl to 140 ml pumps at a range of 3.06 pl/min to 215.8 ml/min.

Maximum Experimental Versatility

The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 1 syringe.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary ?home? for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™ as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- Animal Infusions or Withdrawals—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, nanofluidic circuits, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**88-3016**
Classification	Class I
Dimensions **L x D x H**	12.0 x 8.5 x 7.25 in (30.48 x 21.59 x 18.4 cm)
Display	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	1.8° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F (4°C to 40°C)
Environmental Storage Temperature	14°F to 158°F (-10°C to 70°C)
Flow Accuracy	±0.35%
Flow Rate Maximum	215.8 ml/min using 140 ml syringe
Flow Rate Minimum	3.06 pl/min using 0.5 µl syringe
I O TTL Connectors	15-pin D-Sub Connector
Input Power	50 W, 0.5 A fuse
Installation Category	II
Max Linear Force	200 lb @ 100% Force Selection
Mode of Operation	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping
Net Weight	12.1 lb (5.5 kg)
No of Syringes	1
Non Volatile Memory	Storage of all settings

Specifications **88-3016**

Number of Microsteps per one rev of Lead Screw	6,400
Pollution Degree	1
Pressure Accuracy	±2%
Pump Configuration	Standard
Pump Function	Infuse/Withdraw Programmable
Pusher Travel Rate Maximum	190.8 mm/min
Pusher Travel Rate Minimum	0.36 µm/min
RS 232 Connectors	9 pin D-Sub Connector
Regulatory Certifications	CE, ETL, (UL, CSA), WEEE, EU RoHS & CB Scheme
Step Rate Maximum	52 µsec/µstep
Step Rate Minimum	27.5 sec/µstep
Syringe Rack Type	Standard Rack
Syringe Size Maximum	140 ml
Syringe Size Minimum	0.5 µl
USB Connectors	Type B
Voltage Range	100-240 VAC, 50/60 Hz
Classification	Class I

Standard Infuse/Withdraw Pump 11 Pico Plus Elite Programmable Syringe Pump

The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite is the lowest flow, highest accuracy pump with unparalleled ease of use with a high resolution touch screen with intuitive icon interface. It can deliver volumes down to 0.54 pl/min. This infusion/withdrawal dual syringe pump is ideal for applications such as microdialysis. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

This syringe pump has a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 µl to 10 ml (dual channel version) or 0.5 µl to 60 ml (single channel version). The Pump 11 Pico Plus Elite offers enhanced flow performance with high accuracy and smooth flow from 0.54 pl/min to 11.70 ml/min (dual channel version) or 0.54 pl/min to 39.77 ml (single channel version).

The Pump 11 Pico Plus Elite is an Infusion/Withdrawal Programmable Syringe Pump available in single or dual syringe configurations. This pump has advanced connectivity with a footswitch, USB serial port for computer control, RS-485 (or optional RJ-II) ports for daisy chaining pumps and Digital I/O for remote control.

Item No.	Description
70-4506	Pump 11 Pico Plus Elite Infusion/Withdrawal Programmable Dual Syringe Pump
70-4511	Pump 11 Pico Plus Elite Infusion/Withdrawal Programmable Single Syringe

DETAILS

The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite expands its capabilities to satisfy your experimental requirements. The Pump 11 Pico Plus Elite is the lowest flow, highest accuracy pump with unparalleled ease of use with a high resolution touch screen with intuitive icon interface. It can deliver volumes down to 0.54 pl/min. This infusion/withdrawal dual syringe pump is ideal for applications such as microdialysis. The Pump 11 Elite Series allows you to create, save and run simple to complex methods without a PC.

Features

- New color LCD touch screen
- Intuitive icon interface
- Up-front control knobs for ease of operation
- Quick start methods
- Program simple to complex methods without a PC
- Relative time clock

- Vertical or horizontal orientation
- 35 lb linear force adjustable across the entire flow range
- Can daisy chain pumps
- CE, ETL (UL, CSA), WEEE, EU RoHS & CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Microfluidics
- Microdialysis
- Accurate delivery of coatings
- Reactor dosing
- Cell injections
- Fluid sampling
- High presure injection
- Low pressure chromatography
- Flow programming
- Binary gradients
- % composition step changes
- I/O interactive experiments

This syringe pump has a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5ul to 10 ml (dual channel version) or 0.5 ul to 60 ml (single channel version). The Pump 11 Pico Plus Elite offers enhanced flow performance with high accuracy and smooth flow from 0.54 pl/min to 11.70 ml/min (dual channel version) or 0.54 pl/min to 39.77 ml (single channel version).

The Pump 11 Pico Plus Elite is an Infusion/Withdrawal Programmable Syringe Pump available in single or dual syringe configurations. This pump has advanced connectivity with a footswitch, USB serial port for computer control, RS-485 (or optional RJ-11) ports for daisy chaining pumps and Digital I/O for remote control.

Since 1901 Harvard Apparatus has been supporting bioresearch fluidics requirements with the culmination being the introduction of the first commercial syringe pump for bioresearch in 1956. Since 1956, over 70,000 satisfied syringe pump users around the world have made Harvard Apparatus syringe pumps the worlds #1 choice.

The Pump 11 Pico Plus Elite is a low flow syringe pump designed for use in applications including: microdialysis, microfluidics, cellular injections and fluid sampling.

Program Description

To operate the Pump 11 Pico Plus Elite, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method.

Advanced Programming Features

- Constant Rate
- Ramp
- Gradients
- % composition (up to two solvents)
- Autofill
- I/O — dedicated and user defined I/O

Easy-to-Use Interface

The Pump 11 Pico Plus Elite color LCD touch screen graphic user interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary set up screens for the applications. From those screens you can access all the commands needed to operate the Pump 11 Elite, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main navigational branches, the quick start Methods, user-defined Methods, and system settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface. Advanced GLP Documentation Features:

- Download experimental parameter information to PC
- Alpha/numeric keypad for method naming

Accessories

A full range of accessories are compatible with the Pump 11 Pico Plus Elite including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	**70-4506**	**70-4511**
Pump Configuration	Standard	Standard
Pump Function	Infusion/Withdrawal/Programmable	Infusion/Withdrawal/Programmable
Flow Rate Maximum	11.70 ml/min using 10 ml syringe	39.77 ml/min using 60 ml syringe
Flow Rate Minimum	0.54 pl/min using 0.5 Âµl syringe	0.54 pl/min using 0.5 Âµl syringe
Syringe Size Minimum	0.5 Âµl	0.5 Âµl
Syringe Size Maximum	10 ml	60 ml
Max Linear Force	35 lb @ 100% Force Selection	35 lb @ 100% Force Selection
I O TTL Connectors	15 pin D-Sub Connector	15 pin D-Sub Connector
RS 232 Connectors	optional RJ-11	optional RJ-11
USB Connectors	Type B	Type B
Accuracy	Â±0.35%	Â±0.35%
Non Volatile Memory	Storage of all settings	Storage of all settings
Drive Motor	0.9Â° Stepper Motor	0.9Â° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Number of Microsteps per one rev of Lead Screw	20,480	20,480
Step Rate Minimum	27.5 sec/Âµstep	27.5 sec/Âµstep
Step Rate Maximum	26 Âµsec/Âµstep	26 Âµsec/Âµstep
Step Resolution	0.031 Âµm/Âµstep	0.031 Âµm/Âµstep

Specifications	70-4506	70-4511
Pusher Travel Rate Minimum	0.068 Âµm/min	0.068 Âµm/min
Pusher Travel Rate Maximum	71.55 mm/min	71.55 mm/min
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Input Power	12-30 VDC	12-30 VDC
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz
Dimensions, Control Box L x D x H	9.0 x 7.0 x 6.0 in (22.6 x 17.78 x 15.0 cm)	
Net Weight	4.6 lb (2.1 kg)	
Environmental Operating Temperature	40Â°F to 104Â°F (4Â°C to 40Â°C)	40Â°F to 104Â°F (Â°C to 40Â°C)
Environmental Storage Temperature	14Â°F to 158Â°F (-10Â°C to 70Â°C)	14Â°F to 158Â°F (-10Â°C to 70Â°C)
Environmental 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
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS	CE, UL, CSA, CB Scheme, EU RoHS

Standard Infuse/Withdraw PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. Integrated EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks
- Connectivity: RS-232 and USB for PC; RS-485 for pump to pump daisy chain

Item No.	Description
70-3007	PHD ULTRA™ Syringe Pump Infuse/Withdraw Programmable
70-3009	PHD ULTRA™ Syringe Pump with Push/Pull Mechanism Programmable
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump

Item No.	Description
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)

- Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only)
- LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility

- Configurations: push-pull, standard, remote, high pressure, multi racks

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Features

- Superior drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- Color LCD touch screen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range
- Daisy chain
- Remote configuration available

- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning
- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming
- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method.
2. Enter operating parameters.
3. Preview your method
4. Run your method.

Advanced Programming Features

- **Flow Programming**—change the flow with time, volume or a triggered event as many times as you like
- **Bolus**—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- **Concentration Delivery**—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- **Gradients**
- **% ratio—**up to three solvents
- **I/O** — dedicated and user defined I/O
- **Pulsed Flow**—so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140 ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

The Methods Main or Quick Start screens are the primary home for the applications. From those screens you access all the commands needed to operate the PHD ULTRA™, as well as the main system settings.

The Message Area of the touch screen is used to display helpful instructions for the currently displayed screen. It is also used to display error or warning messages to indicate problem conditions in a Method or error conditions during pump operation.

The software is organized into three main Navigational branches, the quick start operations, preloaded/user-defined Methods, and systems settings. You can control operations directly with the touch screen or remotely from an independent computer or device via the external I/O interface.

Description of Typical Applications

- **Animal Infusions or Withdrawals**—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- **Proportioning and Delivering of Mixtures**—mixing gradients or proportions with independent control of two liquids.
- **Aerosol for Coating**—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- **Delivery to Mass Spectroscopy**—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- **Compensating Flows**—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- **Dispensers/Injectors**—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Pump Models

The PHD ULTRA™ Syringe Pump is available in three configurations designed for different operating environments and varying degrees of operational flexibility.

1. Infuse Only: This model supports infusion operations at user-definable flow rates and with selectable target volume or time values to control the total infusion volume. The entry-level Infuse Only model does not include programmable, user-defined methods.

2. Infuse/Withdraw: This model supports infusion and withdraw operations at user-definable flow rates and with selectable target volumes or time values to control the total volume pumped for both the infusion and withdraw portions of a procedure. This model provides access to many of the advanced method programming options of the PHD ULTRA™, but only supports a single stored method.

3. Infuse/Withdraw Programmable: This model supports both infusion and withdraw operations and can use both simplified pumping profiles or the more advanced pump profiles and I/O settings that permit interactions with external devices. In addition to supporting all of the advanced programming tools available on the PHD ULTRA™, this model also allows users to create and store multiple user-defined methods on the pump.

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

SPECIFICATIONS

Specifications	70-3006	70-3007	70-3008	70-3009
Accuracy	±0.25%	±0.25%	±0.25%	±0.25%
Classification	Class I			
Dimensions, Control Box L xD x H	12.0 x 8.5 x 7.25 in (30.48 x 21.59 x 18.42 c,)			
Display	4.3" WQVGA TFT Color Display with Touchpad			
Drive Motor	0.9° Stepper Motor			
Environmental Humidity	20% to 80% RH, non condensing			
Environmental Operating Temperature	40°F to 104°F* (4°C to 40°C*)			
Environmental Storage Temperature	14°F to 158°F(-10°C to 70°C)			
Flow Rate Maximum	216 ml/min using 140 ml syringe			
Flow Rate Minimum	1.56 pl/min using 0.5 µl syringe			
I/O & TTL Connectors	15 pin D-Sub Connector			
Input Power	50 W, 0.5 A fuse			
Installation Category	II			
Max Linear Force	75 lb @ 100% Force Selection			
Mode of Operation	Continuous			
Motor Drive Control	Microprocessor with 1/16 microstepping			
Net Weight	10 lb (4.5 kg)			
No of Syringes	2			

Specifications	70-3006	70-3007	70-3008	70-3009
Non Volatile Memory	Storage of all settings			
Number of Microsteps per one rev of Lead Screw	12,800			
Pollution Degree	1			
Pump Configuration	Standard			
Pump Function	Infuse/Withdraw			
Pusher Travel Rate Maximum	190.8 mm/min			
Pusher Travel Rate Minimum	0.18 µm/min			
Regulatory Certifications	CE, UL, CSA, CB Scheme, EU RoHS			
Step Rate Maximum	26 µsec/µstep			
Step Rate Minimum	27.5 sec/µstep			
Syringe Rack Type	Standard Rack			
Syringe Size Maximum	140 ml			
Syringe Size Minimum	0.5 µl			
USB Connectors	Type B			
Voltage Range	100-240 VAC, 50/60 Hz			
RS 232 Connectors	9 pin D-Sub Connector			

Remote Infuse/Withdraw PHD ULTRA™ Syringe Pumps

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

Remote Pump Model

The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30 foot RS-485 (IEEE-1394) cable. This makes the pump ideal for use in hazardous environments where the researcher is safer distanced from the material being pumped or for applications where you need to have the pumping mechanism inside an incubator. Every version of the PHD ULTRA™ is available in a remote model.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

1. Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

2. Integrated EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC
   - Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button
   - LCD, high resolution color touch screen for powerful functionality, yet easy to use

3. Multiple levels of versatility
   a. Configurations: push-pull, standard, remote, high pressure, multi racks
   b. Connectivity: RS-232 and USB for PC; RS-485 for pump to pump daisy chain

Item No.	Description
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump

Item No.	Description
70-3030	PHD ULTRA™ RS-232 RJ-11 Connectors Option (If needed, must be purchased at the same time as the Ultra Pump)
70-3033	PHD ULTRA Analog Control Input Option (If needed, must be purchased at the same time as the PHD ULTRA Programmable Pump)
70-3034	PHD ULTRA Internal Fan Option (Required if external operating ambient is >35°C. If needed, fan must be purchased at the same time as the PHD ULTRA™ Pump)

DETAILS

The PHD ULTRA™ Syringe Pump series is a family of high-accuracy, microliter- and milliliter-compatible pumps designed for versatile technical use including mass spectroscopy, calibration, drug and nutritional infusions, microdialysis, dispensing, chromatography and LC/HPLC.

The PHD ULTRA™ is the solution for your most demanding fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users.

Features

- Superior drive mechanism for unmatched smooth flow, accuracy and precision
- From picoliter to 216 ml/min flow rates
- Advanced programming for true multi methods without a PC
- Quick start methods
- Alpha/numeric keyboard without a PC
- Real and relative time clocks
- Icon operation
- Color LCD touchscreen
- Up-front control knobs for ease of operation
- Vertical or horizontal orientation
- Adjustable linear force to 75 lbs across the entire flow range
- Daisy chain
- Remote configuration available
- CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
- 2-year warranty

Applications

- Nanofluidics
- Drug/Nutritional infusions
- Electro-spinning
- Reaction chamber addition
- Mass Spec calibration
- Feeding cells
- Low pressure chromatography
- Continuous flow
- Flow programming

- Gradients
- % composition step changes
- Large flow deliveries
- I/O interactive experiments

Remote Pump Model

The PHD ULTRA™ Remote Pumps consist of a control unit and syringe pumping mechanism all connected via a 30 foot RS-485 (IEEE-1394) cable. This makes the pump ideal for use in hazardous environments where the researcher is safer distanced from the material being pumped or for applications where you need to have the pumping mechanism inside an incubator. Every version of the PHD ULTRA™ is available in a remote model.

The PHD ULTRA™ will change the way you think about syringe pumps. There are three major areas which make the PHD ULTRA™ the new standard for syringe pumps:

Superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump

EZ PRO Software and user interface allow easy programming of methods from simple to complex, all without the use of a PC (I/W and I/W Programmable models only)
a. Preprogrammed methods for simple to complex operations that allow you to be up and running with the push of a button (I/W Programmable models only
b. LCD, high resolution color touch screen for powerful functionality, yet easy to use

Multiple levels of versatility
a. Configurations: push-pull, standard, remote, high pressure, multi racks
b. Connectivity: RS 232 and USB for PC; RS 485 for daisy chain

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Highest Accuracy and Precision

The PHD ULTRA™ syringe pump family has a fluidics drive mechanism which assures ease of use and high performance, for smoother, more accurate flow rates than any other syringe pump. Flow rates are accurate within 0.25% and reproducibility within 0.05%. A microprocessor-controlled, small step angle stepping motor drives a lead screw and pusher block. Advanced micro-stepping techniques are employed to further reduce the step angle to eliminate flow pulsation.

Program Description

To operate the PHD ULTRA™, the user defines all the required parameters for infusing or withdrawing liquids through a Pump Control Method. The basic operation is a simple 4-step procedure:

1. Select a method
2. Enter operating parameters
3. Preview your method
4. Run your method

Advanced Programming Features

- Flow Programming—change the flow with time, volume or a triggered event as many times as you like
- Bolus—inject a drug (or drugs) in a high quantity at once. The bolus injection can be made in time or volume.
- Concentration Delivery—calibrate flow in concentration units of mg/kg easily so flow is calibrated to concentration of drug and animal weight.
- Gradients
- % ratio—up to three solvents
- I/O—dedicated and user defined I/O
- Pulsed Flow—so you can program the pulse easily

Widest Flow Rate Range

This pump is engineered to provide flow accuracy within 0.25% and reproducibility within 0.05%. Single or multi syringes from 0.5 µl to 140 ml pump at a range of 0.0001 µl/hr to 216 ml/min.

Maximum Experimental Versatility

The PHD ULTRA™ features true Multi-Pump Operation. The pump can be oriented vertically or horizontally for optimum experimental connectivity. This pump comes standard to hold 2 syringes, but can be purchase with 3 other syringe racks: 6 to 10 syringe rack, 4 x 140ml syringe rack and 4 x microliter syringe rack.

Easy-to-Use Interface

The PHD ULTRA™ color LCD touch screen graphic interface is divided into three basic areas: Operations Display, Message Area, and Navigation. This configuration allows you to easily move through all menu selections and data entry by gently touching the onscreen buttons with a finger or the tip of a soft, non-sharp object such as a pencil eraser.

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- Animal Infusions or Withdrawals—the PHD ULTRA™ will control the delivery of varying % of nutrients or drugs infused into animals, flush lines using catheters, needles, cannulae or microdialysis.
- Proportioning and Delivering of Mixtures—mixing gradients or proportions with independent control of two liquids.
- Aerosol for Coating—the pump at high pressure can create an aerosol for the delivery of coating materials such as pharmaceutical tablets and aerosol studies.
- Delivery to Mass Spectroscopy—the delivery of fluids to the MS for calibration, matrix addition or ESI sample.
- Compensating Flows—the continuous infusion and simultaneous withdrawal of liquids for cell cultures or perfusion chambers.
- Dispensers/Injectors—Adhesives, Cell injection, MRI Dyes, Activators/Enzymes, Flow injection, Microreaction vessels, or Stereotaxic delivery.

Advanced GLP Documentation Features

- Experiment parameter download information to PC
- Alpha/numeric capability

Syringe Racks

The PHD ULTRA™ is offered with a variety of syringe racks to meet your specific application.

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. (pump must be returned to the factory for all upgrades)

Accessories

A full range of accessories are compatible with the PHD ULTRA™ including syringe heaters, connectors, tubing, syringes and more.

SPECIFICATIONS

Specifications	70-3306	70-3307	70-3308	70-3309
Accuracy	±0.25%	±0.25%	±0.25%	±0.25%

Specifications	70-3306	70-3307	70-3308	70-3309
Classification	Class I	Class I	Class I	Class I
Dimensions,Control Box L x D x H	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)	12 x 8.5 x 4.25 in (30.48 x 21.59 x 10.80 cm)		
Dimensions, Remote Box L x D x H	11.0 x 5.3 x 6.5 in (27.94 x 13.46 x 16.51 cm)			
Display	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad	4.3" WQVGA TFT Color Display with Touchpad
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor
Environmental Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Environmental Operating Temperature	40°F to 104°F 4°C to 40°C	40°F to 104°F 4°C to 40°C	40°F to 104°F 4°C to 40°C	40°F to 104°F 4°C to 40°C
Environmental Storage Temperature	14°F to 158°F -10°C to 70°C	14°F to 158°F -10°C to 70°C	14°F to 158°F -10°C to 70°C	14°F to 158°F -10°C to 70°C
Flow Rate Maximum	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe	216 ml/min using 140 ml syringe
Flow Rate Minimum	1.5 pl/min using 0.5 µl syringe	1.5 pl/min using 0.5 µl syringe	1.5 pl/min using 0.5 µl syringe	1.5 pl/min using 0.5 µl syringe
I/O & TTL Connectors	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector
Input Power	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse	50 W, 0.5 A fuse
Installation Category	II	II	II	II
Max Linear Force	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection	75 lb @ 100% Force Selection
Mode of Operation	Continuous	Continuous	Continuous	Continuous
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Net Weight	13.4 lb (6.1 kg)	13.4 lb (6.1 kg)	13.4 lb (6.1 kg)	13.4 lb (6.1 kg)
No of Syringes	2	2	4	4

Specifications	70-3306	70-3307	70-3308	70-3309
Non Volatile Memory	Storage of all settings	Storage of all settings	Storage of all settings	Storage of all settings
Number of Microsteps per one rev of Lead Screw	12,800	12,800	12,800	12,800
Pollution Degree	1	1	1	1
Pump Configuration	Remote	Remote	Remote	Remote
Pump Function	Infuse/Withdraw	Infuse/Withdraw, Programmable	Push/Pull	Push/Pull, Programmable
Pusher Travel Rate Maximum	190.8 mm/min	190.8 mm/min	190.8 mm/min	190.8 mm/min
Pusher Travel Rate Minimum	0.18 µm/min	0.18 µm/min	0.18 µm/min	0.18 µm/min
RS 232 Connectors	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector	9 pin D-Sub Connector
Regulatory Certifications	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme	CE, ETL(UL, CSA), WEEE, EU RoHS + CB Scheme
Step Rate Maximum	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep
Step Rate Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Syringe Rack Type	Standard Rack	Standard Rack	Standard Rack	Standard Rack
Syringe Size Maximum	140 ml	140 ml	140 ml	140 ml
Syringe Size Minimum	0.5 µl	0.5 µl	0.5 µl	0.5 µl
USB Connectors	Type B	Type B	Type B	Type B
Voltage Range	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz	100-240 VAC, 50/60 Hz

Harvard PHD 22/2000 Pump Accessories

Harvard PHD 22/2000 Pump Accessories

Item No.	Description
72-0199	Remote Extension Cable, 1.5 m (5 ft) for PHD 22/2000 remote syringe pumps including the PHD 22/2000 HPSI
61-0270	Continuous Flow Tubing Segment for PHD ULTRA™ & PHD 22/2000 Push/Pull Syringe Pump

DETAILS

Harvard PHD 22/2000 Pump Accessories

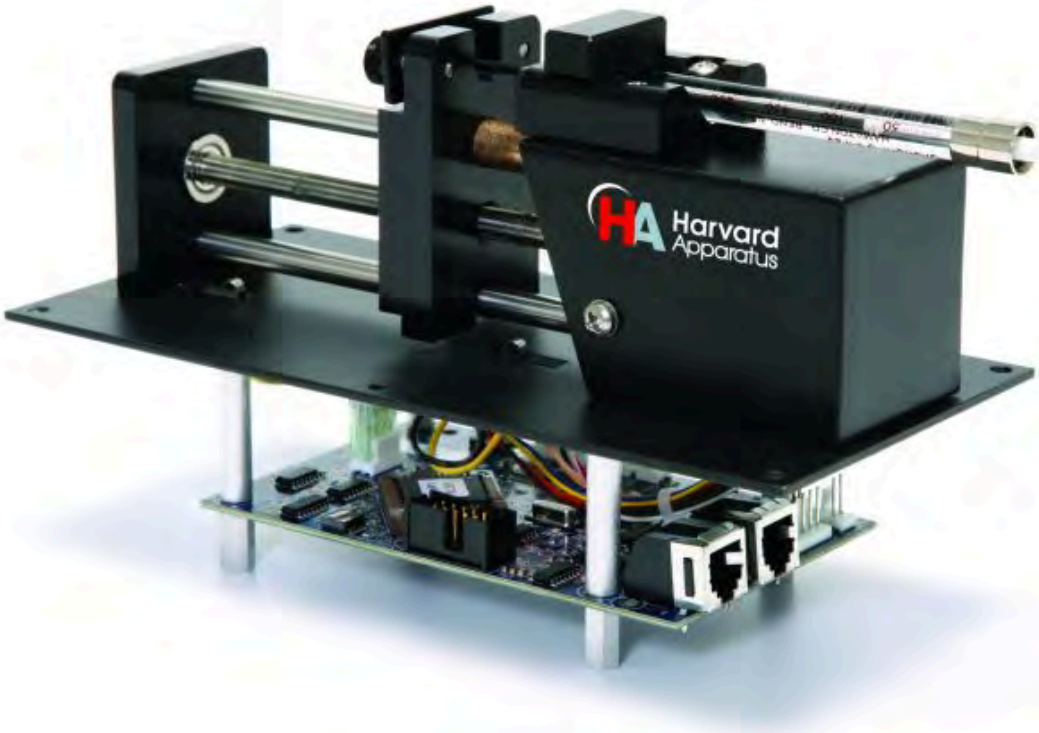
SPECIFICATIONS

Specifications	61-0270
ID English	0.062
Length	3 x 112 in. sections
Length English	
Length Metric	
Materials	Polycarbonate, silicone
Pressure	15

Microliter OEM Syringe Pump Modules

The “µl” Pump Module is a low cost, highly precise, single syringe infuse/withdraw pump capable of low to moderate back pressures. It is available in one version only and will hold one syringe of any make from 0.5 µl to 1 ml. The inside diameter of the syringe and desired flow rate are entered via the RS-232 serial port, and the internal microprocessor drives a precision stepper motor to produce accurate fluid flow. This unit is designed to operate inside an enclosure, cabinet, or on top of a bench. The board may be removed for “remote” operation.

Item No.	Description
70-2220	Microliter Syringe Pump Module without power Supply



DETAILS

The “µl” Pump Module is a low cost, highly precise, single syringe infuse/withdraw pump capable of low to moderate back pressures. It is available in one version only and will hold one syringe of any make from 0.5 µl to 1 ml. The inside diameter of the syringe and desired flow rate are entered via the RS-232 serial port, and the internal microprocessor drives a precision stepper motor to produce accurate fluid flow. This unit is designed to operate inside an enclosure, cabinet, or on top of a bench. The board may be removed for “remote” operation.

Features

- RoHs compliant
- Low cost syringe pump
- Easy to incorporate legendary syringe pump technology into your equipment
- Precisely dispenses micro-liter volumes
- Smooth flow
- Two modes of operation
  - Constant flow rate
  - Volume dispense

Two Modes of Operation—Constant Flow Rate and Volume Dispense

The “µl” Pump Module will operate continuously in RATE mode or accurately dispense a specific amount of fluid in VOLUME mode. When starting the pump, RATE mode will be the default mode. To operate in Volume mode, set a target volume and the pump will change modes to suit desired operation. This is the safest way to use the “µl” Pump Module. The pump will automatically stop when target volume is dispensed.

Smooth Flow

New micro-stepping pump profiles deliver very smooth and consistent flow.

Location Requirements for the Syringe Pump

- A sturdy, level, clean and dry surface
- Minimum of one inch (2.5 cm) clearance around the pump
- Adequate power supply
- Operating temperature 0° to 35°C (32° to 95°F)
- Relative humidity 20% to 80%

Protecting Small, Fragile Syringes

The “µl” Pump Module will hold microliter size syringes down to 0.5µl size. These small syringes have fine wire plungers that may be damaged if allowed to bottom out. The “µl” Pump Module is equipped with adjustable limit switches on the bottom side of the mounting plate. Make sure to adjust the limit switches to prevent damage to small syringes.

SPECIFICATIONS

Item #	**70-2220/70-2225**
Description	Microliter OEM Syringe Pump Modules
Type	Microprocessor single syringe, infusion/withdrawal
Accuracy	±0.5%
Reproducibility	±0.1%
Syringe Type	Glass or plastic
Syringe Size	0.5 µl (min) to 1 ml (max)
Flow Rate	0.001 µl/hr (min) to 1.33 ml/min (max)
Average Linear Force	2.73 kg (6 lb) at 100% force selection
RS-232 Connector	4-pin RJ-11 telephone jack; dual RS-232 ports
DC Power Connector	2-pin Header (friction lock)
Power	+12 to +40 VDC, 5%, 1 A (12 W) (User supplied)
Overall Dimensions, H x W x D	11.4 x 23.5 x 8.3 cm (4.5 x 9.25 x 3.25 x 4.5 in)
Mounting Dimensions, H x W x D	22.2 x 7.0 cm (8.75 x 2.75 in), Mounting holes for (4) #8 screws
Weight	0.84 kg (1.85 lb)

Harvard PHD ULTRA™ Accessories

Multi-Racks, Upgrades, Cables, Adapters and Accessories for the PHD ULTRAâ„¢ syringe pump family.

Item No.	Description
70-2215	Footswitch (w/ Phono Plug)
70-3021	PHD ULTRA™ 4 x 140 MultiRack
70-3021A	PHD ULTRA™ 4 x 140 MultiRack - when purchased with Pump
70-3022	PHD ULTRA™ MicroDialysis MultiRack
70-3022A	PHD ULTRA™ MicroDialysis MultiRack - when purchased with Pump
70-3024	PHD ULTRA™ 6/10 MultiRack
70-3024A	PHD ULTRA™ 6/10 MultiRack - when purchased with Pump
70-4000	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite RS-485 Cable for Pump-to-Pump Communication, 0.5 m
70-4001	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite RS-485 Cable for Pump-to-Pump Communication, 2 m
70-4002	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite USB Cable for PC-to-Pump Communication, 2 m

Item No.	Description
70-4003	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite USB Cable for PC-to-Pump Communication, 5 m
70-4004	PHD ULTRA™ RS-232 Cable for PC-to-Pump Communication, 9 pin D-sub, 2 m
70-4006	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite Adapter, D-sub 15 to Term. Blk
70-4013	Lubricant, SuperLube
70-4020	RS-485 Cable for Pump-to-Pump Communication, 9 m (30 ft)
70-4021	RS-485 Cable for Pump-to-Pump Communication, 1 m (3 ft)

DETAILS

Multi-Racks, Upgrades, Cables, Adapters and Accessories for the PHD ULTRAâ„¢ syringe pump family.

PHD ULTRA™ 4400 OEM Open Baseplate Syringe Pump Module

As an Original Equipment Manufacturer (OEM), your success depends on your reputation. And your reputation is literally built on your ability to consistently deliver reliable, quality products at competitive prices.

When it comes to manufacturing pumps, it is essential that you have best-in class components that offer flexibility, so you can satisfy your varying application needs. And, it is critical that the mechanisms you use consistently deliver the precise, accurate and reliable flow that your customers demand.

Wouldn't it be nice to partner with a reputable vendor who could provide both proven, state-of-art mechanisms and the support you need to easily and affordably develop your fluidics analysis systems?

Harvard Apparatus has a wealth of experience in the development and manufacture of specialized fluidic systems. With a full line of OEM pumps, we offer the broadest selection of fluidics components, systems and specials. Whether your requirement is for a single order/one-time study or you need a fluidic module to integrate into your systems, we have the solution. And, we can readily customize to best meet your application needs.

Cited in thousands of studies across a myriad of applications, Harvard Apparatus pumps are best-in-class. In fact, from pre-clinical disease to microfluidic disease modeling to drug creation and drug testing, our syringe pumps are already relied upon globally by tens of thousands of scientists to reach their research objectives.

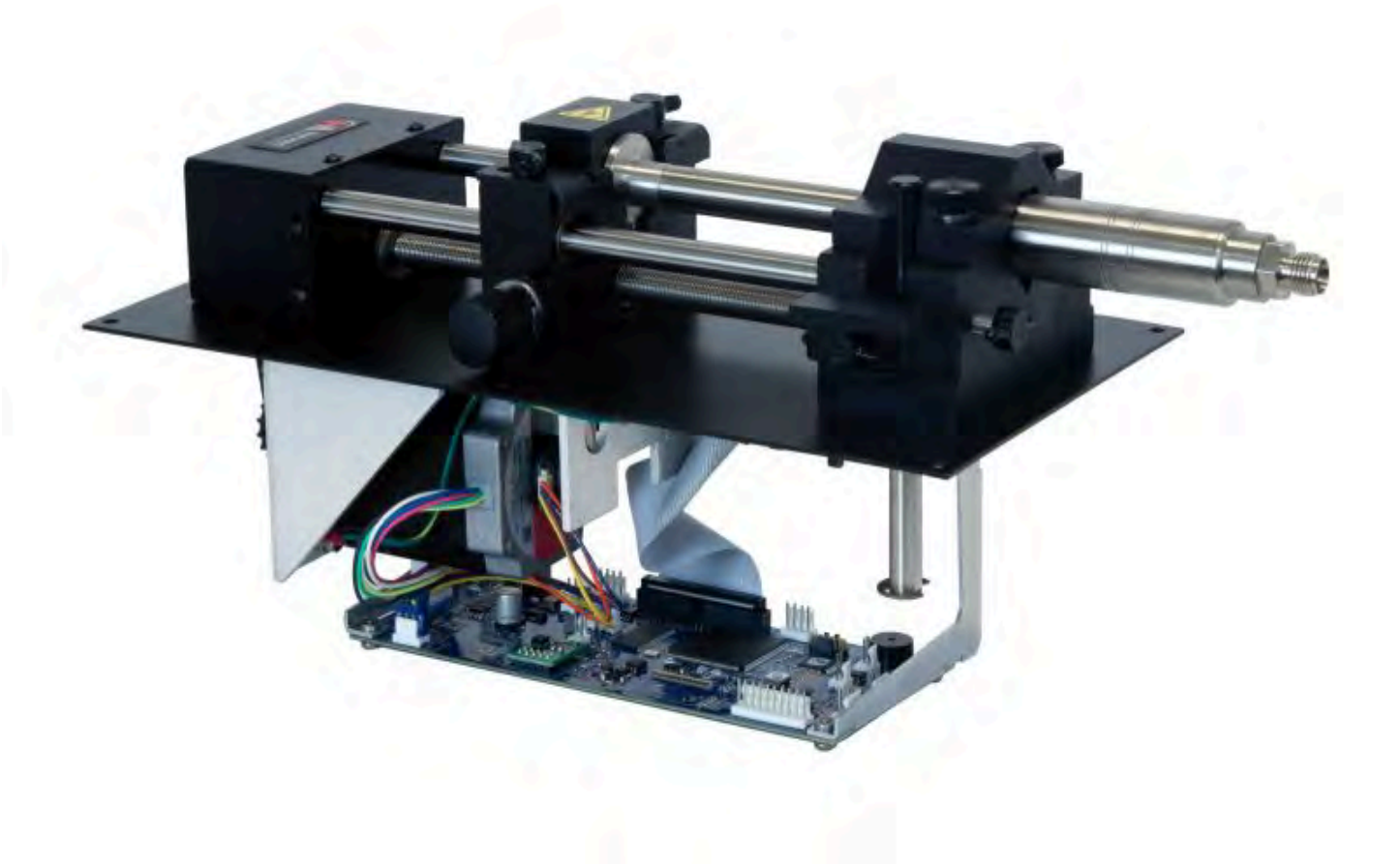
The PHD ULTRA™ 4400 is the solution for your most demanding high pressure fluidics applications. This pump represents the latest technology in syringe pumps and was developed utilizing the feedback of the world's largest populations of syringe pump users. This syringe pump platform has superior mechanical drive mechanism and syringe holding mechanics to achieve the highest performance of any syringe pump.

The PHD ULTRA™ 4400 is a single syringe infusion/withdrawal programmable syringe pump with a flow rate range of 3.06 pl/min to 216.0 ml/min with 200 lb of adjustable force across the entire flow rate range.

This innovative high pressure syringe pump component has a footswitch input, RS-232 and USB serial ports for computer control, RS-485 ports for daisy chaining pumps and Digital I/O for external control via an independent computer or device.

Item No.	Description
70-3610	PHD ULTRA™ 4400 Open Baseplate Single Syringe
70-4029	30 V Power Supply with US Cord

Item No.	Description
70-4030	30 V Power Supply with EU Cord



DETAILS

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SPECIFICATIONS

Specifications	**70-3610**
Accuracy	± 0.35%
Syringe (Min./Max.)	0.5 µl / 140 ml single
Flow Rate:	
Minimum (0.5 µl syringe)	3.16 pl/min
Maximum (140 ml syringe)	215.8 ml/min
Display	None
Non-Volatile Memory	Stores all settings
Connectors:	
RS-485	IEEE-1394, 6 pos
USB	Type B
I/O & TTL	15-pin D-Sub Connector
Footswitch	Mini phono jack
RS-232 (option)	RJ-11
Linear Force (Max)	91 kg (200 lb) @ 100% Force Selection
Drive Motor	0.9° Stepper Motor

Motor Drive Control	Microprocessor with 1/16 microstepping
Microsteps/revolution of lead screw	6.400
Step Resolution	0.164 µm/µstep
Step Rate:	
Minimum	27.5 sec/µstep
Maximum	52 µsec/µstep
Pusher Travel Rate:	
Minimum	0.15 µm/min
Maximum	159.00 mm/min
Input Power	12 to 30 VDC, 50 W (30V recommended)
Power Supply	Not included
Dimensions	11.9 x 6.0 x 6.5 (30.2 x 15.2 x 46.6 cm)
Weight	3.86 kg (8.50 lb)
Atmospheric Conditions	
Operating Temperature	4°C to 40°C (40°F to 104°F)
Storage Temperature	-10°C to 70°C (14°F to 158°F)
Storage Humidity	20% to 80% RH, non condensing
Method of Operation	Continous
Classification	Class I
Pollution Degree	1
Installation Category	II
Supplier Name	Harvard Appartus
Supplier Address	84 October Hill Rd., Holliston, MA 01746
Supplier Phone Number	(508) 893--8999
Regulatory Certifications	WEEE, EU RoHS

Harvard Pump 11 Elite, Pico Plus Elite & Nanomite Accessories

Cables, Adapters and Accessories for the Pump 11 Elite, Pico Plus Elite & Nanomite syringe pump families.

Item No.	Description
70-4000	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite RS-485 Cable for Pump-to-Pump Communication, 0.5 m
70-4001	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite RS-485 Cable for Pump-to-Pump Communication, 2 m
70-4002	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite USB Cable for PC-to-Pump Communication, 2 m
70-4003	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite USB Cable for PC-to-Pump Communication, 5 m
70-4006	PHD ULTRA™, Pump 11 Elite, Pico Plus Elite & Nanomite Adapter, D-sub 15 to Term. Blk
70-4013	Lubricant, SuperLube
70-4020	RS-485 Cable for Pump-to-Pump Communication, 9 m (30 ft)
70-4021	RS-485 Cable for Pump-to-Pump Communication, 1 m (3 ft)

DETAILS

Cables, Adapters and Accessories for the Pump 11 Elite, Pico Plus Elite & Nanomite syringe pump families.

Pump 11 Elite / Pico Plus Elite OEM Open Baseplate Syringe Pump Module

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Cited in thousands of studies across a myriad of applications, Harvard Apparatus pumps are best-in-class. In fact, from pre-clinical disease to microfluidic disease modeling to drug creation and drug testing, our syringe pumps are already relied upon globally by tens of thousands of scientists to reach their research objectives.

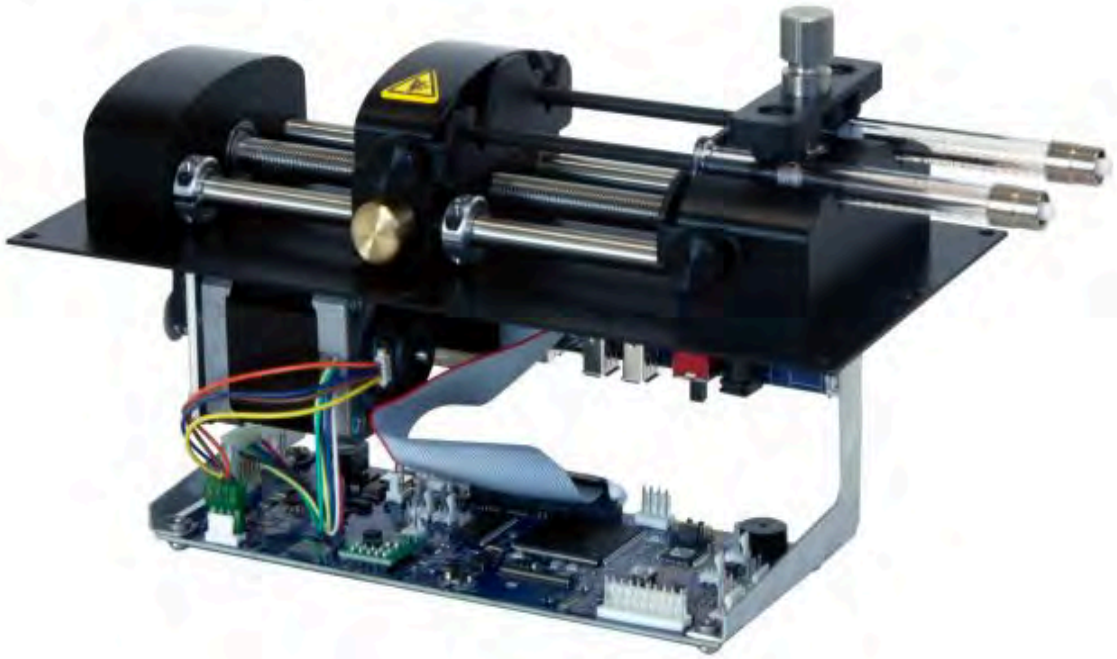
The Pump 11 Elite / Pico Plus Elite OEM Series of syringe pumps expands its capabilities to satisfy your syringe pump integration requirements.

This OEM Series of syringe pumps have a new mechanism that includes a tight gripping, more secure syringe clamp for syringes ranging from 0.5 ul to 60 ml (single syringe) and 0.5 ul to 10 ml (dual syringe).

The Pump 11 Elite Series offers enhanced flow performance with high accuracy and smooth flow from 1.28 pl/min to 88.28 ml/min (Pump 11 Elite) or 0.54 pl/min - 39.77 ml/min (Pico Plus Elite). The Pump 11 Elite/Pico Plus Elite Series is available with single or dual syringe racks. These innovative syringe pump components have advanced connectivity with a USB serial port for computer control and Digital I/O for remote control.

Item No.	Description
70-4810	Pump 11 Elite Open Baseplate Single Syringe
70-4811	Pump 11 Elite Open Baseplate Dual Syringe
70-4812	Pump 11 Pico Open Baseplate Single Syringe

Item No.	Description
70-4813	Pump 11 Pico Open Baseplate Dual Syringe
70-4026	24 V Power Supply with US Cord
70-4027	24 V Power Supply with EU Cord
70-4028	24 V Power Supply with UK Cord



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SPECIFICATIONS

Specifications	**70-4810**	**70-4811**	**70-4812**	**70-4813**
Accuracy	± 0.5%	± 0.5%	± 0.35%	± 0.35%
Syringe (Min./Max.)	0.5 µl / 60 ml single	0.5 µl / 10 ml dual	0.5 µl / 60 ml single	0.5 µl / 10 ml dual
Flow Rate:				
Minimum (0.5 µl syringe)	1.26 pl/min	1.26 pl/min	0.54 pl/min	0.54 pl/min
Maximum (10 ml syringe)	26.02 ml/min	26.02 ml/min	11.70 ml/min	11.70 ml/min
Maximum (60 ml syringe)	88.40 ml/min	-	39.7 ml/min	-
Display	None	None	None	None
Non-Volatile Memory	Stores all settings	Stores all settings	Stores all settings	Stores all settings
Connectors:				

RS-485	IEEE-1394, 6 pos	IEEE-1394, 6 pos	IEEE-1394, 6 pos	IEEE-1394, 6 pos
USB	Type B	Type B	Type B	Type B
I/O & TTL	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector	15-pin D-Sub Connector
Footswitch	Mini phono jack	Mini phono jack	Mini phono jack	Mini phono jack
RS-232 (option)	RJ-11	RJ-11	N/A	N/A
Linear Force (Max)	16 kg (35 lb) @ 100% Force Selection	16 kg (35 lb) @ 100% Force Selection	16 kg (35 lb) @ 100% Force Selection	16 kg (35 lb) @ 100% Force Selection
Drive Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor	0.9° Stepper Motor
Motor Drive Control	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping	Microprocessor with 1/16 microstepping
Microsteps/revolution of lead screw	15.360	15.360	20.480	20.480
Step Resolution	0.069 µm/µstep	0.069 µm/µstep	0.031 µm/µstep	0.031 µm/µstep
Step Rate:				
Minimum	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep	27.5 sec/µstep
Maximum	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep	26 µsec/µstep
Pusher Travel Rate:				
Minimum	0.15 µm/min	0.15 µm/min	0.068 µm/min	0.068 µm/min
Maximum	159.00 mm/min	159.00 mm/min	71.55 mm/min	71.55 mm/min
Input Power	12 to 30 VDC (24V recommended)	12 to 30 VDC (24V recommended)	12 to 30 VDC (24V recommended)	12 to 30 VDC (24V recommended)
Power Supply	Not included	Not included	Not included	Not included
Dimensions	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)	24.13 x 17.15 x 10.67 cm (9.5 x 6.75 x 4.2 in)
Weight	1.68 kg (3.70 lb)	1.68 kg (3.70 lb)	1.68 kg (3.70 lb)	1.68 kg (3.70 lb)
Atmospheric Conditions				
Operating Temperature	4°C to 40°C (40°F to 104°F)	4°C to 40°C (40°F to 104°F)	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)	-10°C to 70°C (14°F to 158°F)	-10°C to 70°C (14°F to 158°F)
Storage Humidity	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing	20% to 80% RH, non condensing
Method of Operation	Continous	Continous	Continous	Continous
Classification	Class I	Class I	Class I	Class I
Pollution Degree	1	1	1	1
Installation Category	II	II	II	II
Supplier Name	Harvard Appartus	Harvard Appartus	Harvard Appartus	Harvard Appartus
Supplier Address	84 October Hill Rd., Holliston, MA 01746	84 October Hill Rd., Holliston, MA 01746	84 October Hill Rd., Holliston, MA 01746	84 October Hill Rd., Holliston, MA 01746
Supplier Phone Number	(508) 893--8999	(508) 893--8999	(508) 893--8999	(508) 893--8999
Regulatory Certifications	WEEE, EU RoHS	WEEE, EU RoHS	WEEE, EU RoHS	WEEE, EU RoHS

По вопросам продаж и поддержки обращайтесь:

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