



# Model 310 Plus Series

## User's Manual

# Table of Contents

---

SUBJECT	PAGE #
<b>General Safety Summary</b>	2
<b>Technical Specifications</b>	4
<b>Features</b>	5
<b>Keypad Functions</b>	6
<b>Operating Instructions</b>	
Power Switch	7
Main Menu	7
Syringe Diameter Entry	7
Volume Entry	8
Flowrate Entry	8
Start the Pump	9
Power Failure Mode	9
Change or Review Volume Setting While Running	10
Change or Review Rate Setting While Running	10
Fast Forward/Fast Reverse	10
<b>Loading the Syringe</b>	11
<b>NV Ram Failure</b>	11
<b>Fuses</b>	12
<b>Voltage Selector</b>	12
<b>Maintenance</b>	12
<b>Flowrate/Syringe Diameter Table</b>	13
<b>Model Numbers</b>	14
<b>Limited Warranty</b>	15

# General Safety Summary

---

Please read the following safety precautions to ensure proper use of your syringe pump. To avoid potential hazards and product damage, use this product only as instructed in this manual. If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired.

## To Prevent Hazard or Injury:

### **Avoid Exposed Circuitry**

Do not touch any electronic circuitry inside of the product.

### **Avoid Pinch Hazard**

A pinch hazard may exist between the Pusher Block and the End Blocks. Avoid placing fingers between these points while the pump is running.

### **Do Not Operate with Suspected Failures**

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

### **Ground the Product**

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

### **Make Proper Connections**

Make sure all connections are made properly and securely.

# General Safety Summary

---

## Observe all Terminal Ratings

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

## Orient Equipment Properly

Do not position the equipment such that it is difficult to reach the disconnecting device.

## Place Product in Proper Environment

Review the operating manual for guidelines for proper operating environments.

## Use Proper Fuse

Use only specified fuses with product.

## Use Proper Line Cord

Use only the line cord shipped with the product and make sure the line cord is certified for the country of use.

## Observe all Warning Labels on Product

Read all labels on product to ensure proper usage.



**CAUTION**  
Refer to Manual



Protective  
Ground Terminal



**CAUTION:** This pump is not registered with the FDA and is not for clinical use on human or veterinary patients. It is intended for research use only.

# Technical Specifications

---

<b>Model</b>	310 Plus
<b>Syringe Size</b>	1 - 250 microliter
<b>Electrical Rating</b>	Model 115V~, 0.1A CE model 230V~, 0.06A
<b>Fuse</b>	5 x 20 mm, 250V~, slow blow, 0.1A
<b>Voltage Operating Range</b>	Model 100-120V~, 50/60Hz CE model 200-240V~, 50/60Hz
<b>Drive Mechanism</b>	Microprocessor controlled stepper motor (½ microstep), leadscrew
<b>Force</b>	2 lbs (minimum)
<b>Pusher Advance per Half Step</b>	1.58 microns
<b>Step Rate Min/Max</b>	One ½ step every 4 sec / 916 ½ steps/second
<b>Flowrate Range</b>	0.001 - 363.7 µl/min [0.5 - 250 µl syringes]
<b>Dimensions</b>	9 x 6 x 3 in (23 x 15.25 x 8 cm) controller 7.31 x 1.7 x 2in (18.6 x 4.4 x 5.1 cm) injector
<b>Weight</b>	4.5 lb (2 kg)
<b>Atmospheric Specs</b>	
<b>Temperature</b>	4° C - 40° C (40° F - 104° F)
<b>Humidity</b>	20% to 80% RH, non-condensing
<b>Mode of Operation</b>	Continuous
<b>Classification</b>	Class I
<b>Pollution Degree</b>	2
<b>Installation Category</b>	II
<b>Output</b>	N/A
<b>Physiological Effects</b>	N/A
<b>Cooling Conditions</b>	No special considerations
<b>Mechanical Stability</b>	No special considerations
<b>Protective Packaging</b>	No special considerations
<b>Earth Terminals</b>	No External connections required
<b>Removable Protective Means</b>	N/A
<b>Supplier Name</b>	KD Scientific Inc.
<b>Address</b>	84 October Hill Road, Holliston, MA 01746

# Features

---

The Model 310 Plus is an infusion/withdrawal syringe pump designed to hold glass syringes [Hamilton] from 1 to 250 microliters.

Setup and pump operation is extremely simple. A menu, displayed on an alphanumeric LCD “prompts” the operator to make the necessary selections using the keypad for choice of features and numerical entries.

The **internal diameter of the syringe** is used by the control program to calibrate the pump and deliver the volume and flow rate selected. For simplicity the syringe diameter is also used to set automatically the volume and flow rate units.

The syringe diameter can be **entered directly** or the syringe can be identified from a **table of syringes** held in memory. When the syringe is selected from the table the diameter is entered automatically.

Two dispense modes are available:

- a. **Dispense volume mode** in which the pump keeps track of the volume dispensed and automatically stops the pump when a set target volume is reached.
- b. **Run mode** where the pump runs at the set flow rate until manually stopped.

In the event of a **power interruption** during operation, the pump can be programmed to either resume operation or remain stopped when power is returned.

For convenience, all pump **settings are stored in non-volatile memory** to minimize the number of setting changes required.

**Important: The KDS 310 Plus injector and controller are not interchangeable with the KDS 310.**

# Keypad Functions

---



This key has two functions:

- a. Moves the display to the left.
- b. Causes the numerical entry to decrease. To change the displayed number by a single unit press and release the key quickly. If the key is pressed longer the number changes with increasing speed.



This key has two functions:

- a. Moves the display to the right.
- b. Causes the numerical entry to increase. To change the displayed number by a single unit press and release the key quickly. If the key is pressed longer the number changes with increasing speed.

**select**

This key has three functions:

- a. Return to main menu when pressed repeatedly.
- b. Selects the pulsing or “highlighted” feature of the main menu display.
- c. Enter numerical values.

**run/stop**

This key has two functions:

- a. Turns the motor on and off.
- b. Acts as a “pause” during a dispense.

## DISPLAY

After the pump is programmed an arrow on the right side of the display indicates the direction of operation. This arrow pulses when the pump is running.

# Operating Instructions

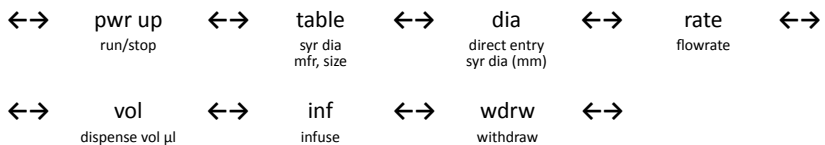
---

## POWER SWITCH

The power switch is located at the right, rear corner of the pump. When the power is turned on the LCD will display the Volume or Rate setting. Press the **select** key to return to the main menu.

## MAIN MENU

Pressing **select** repeatedly will always return the display to the main menu. The main menu consists of five variables, three of which are displayed at all times. The center variable pulses to indicate that this option can be reviewed or changed. The menu acts as a continuous loop and the arrow keys, **←** **→** are used to move around the loop. The variable to be changed can be selected with the **select** key.



## SYRINGE DIAMETER ENTRY

Syringe diameter must be entered for automatic internal calibration. Once the diameter is entered, it is retained in non-volatile memory and need not be entered again unless the syringe being used is changed. When a syringe diameter is changed the Volume and Rate settings are set to zero.

There are two methods of diameter entry.

### a. Internal Library

Select **TABLE** from the main line menu. The table of syringes is organized by manufacturer and then by size. Use the **arrow** keys to scroll through the table and the **select** key to enter the correct setting.

First, scroll through the manufacturers and select the manufacturer of the syringe used. The menu will next display either syringe type or syringe size.

Again, use the **arrow** keys to move through the table until the correct size is displayed. Press the **select** key when the correct syringe size is displayed. This automatically enters the internal syringe diameter.

See Table of Syringe Diameters for the syringe library.

### b. Direct Entry

From the main menu select **DIA**. The display will read “xx.xx mm”. Use the **arrow** keys to display the measured internal diameter of the syringe in millimeters and enter with the **select** key.

Changing the diameter clears the Volume and Rate settings, and the display will now prompt for the new Volume setting.



# Operating Instructions

---

## VOLUME ENTRY

The volume setting mode is selected from the main menu or is displayed automatically after changing the diameter.

Display reads: xx.xx  $\mu$ l (Units displayed in  $\mu$ l)

1. Use the **arrow** keys to enter the dispense volume required.
2. When the correct dispense volume is displayed save this number with the select key.

*Note: If no target dispense volume is required, enter volume = 0.0. The pump will run at the set flowrate until stopped manually or a stall occurs.*

3. After setting a volume the menu prompts for the flowrate setting. When the pump runs, the actual dispensed volume will be displayed and will increment until the set volume is reached, at which time the pump will stop automatically.

## FLOWRATE ENTRY

RATE can be selected from the main menu or will be displayed automatically after the volume setting.

The display reads: Rate: X.X  $\mu$ l/min

Rate units are  $\mu$ l/h or ml/h, microliter or milliliter/hour and are selected automatically according to the syringe diameter.

1. Use the arrow keys to display the flowrate required.
2. Enter the rate with the select key.
3. If the rate entered is out of range, a message is displayed.

To continue, enter a lower rate or select a larger syringe.

*Note:*

- a. *If a dispense volume was set then the display will now change to "Volume : 0.0", that is, in automatic dispense mode.*

*When the pump runs, the actual dispensed volume will be displayed and will increment until the set volume is reached, at which time the pump will stop automatically.*

- b. *If no dispense volume is set, the LCD displays the set flowrate and, when running, the directional indicator arrow will pulse.*

# Operating Instructions

---

## START THE PUMP

- a. Press the **run/stop** key to start the pump. A second press will stop the pump.
- b. If the pump is stopped during a dispense, the volume accumulator is not cleared - the dispense is paused. Restarting the pump with a second press of the **run/stop** key continues the dispense to the target volume.

## POWER FAILURE MODE

If there is a temporary power interruption, when no dispense volume is selected, the **Power Up run/stop** option allows the pump to either resume the dispense when the power returns, or remain stopped but display a message warning of the power failure.

1. Move the main menu to the right and select PWR UP.
  2. The display will read Power Up Run (or STOP). Use the arrow keys to change display and select the required option.
- Run      After power is returned, the pump resumes normal operation. The display flashes PowerFailed to acknowledge a power interruption. Press Select to display the Rate.
- STOP     Pump does not run when power returns. The LCD displays the rate setting.

If a dispense volume is entered the power interruption stops the pump, clears the volume accumulator and returns the volume to the setpoint. Only if the power failure setting is “run” will the power failure warning be displayed.

# Operating Instructions

---

## CHANGE OR REVIEW VOLUME SETTING WHILE RUNNING

While the pump is running it is possible to look at the volume and flowrate settings without interrupting the operation of the pump. If required, the volume and flowrate settings can be changed while the pump continues to run. When the changes are entered the pump immediately changes to the new settings.

1. While operating, press **select** to return to the main menu.
2. Select Volume to display the set dispense volume. If no change is required press **select**.
3. For a volume change use the arrow keys and enter with the **select** key.
4. The display moves to RATE, permitting a change if required. Press **select** if no change is required, or use the **arrow** keys to change the setting. The **select** key immediately changes to the new flowrate and the volume display continues to increment, uninterrupted to the new dispense setting.

*Note: If the VOLUME is changed to a setting smaller than the volume already accumulated then the pump stops when the new, smaller dispense volume is selected.*

## CHANGE OR REVIEW RATE SETTING WHILE RUNNING

1. Press **select** to change the volume accumulator display to the main menu.
2. Select RATE.
3. Make rate changes, if required, and press **select**.

The pump immediately changes to the new flow rate and displays the continuing volume accumulation uninterrupted by the change in flowrate.

## FAST FORWARD/FAST REVERSE

Press the **run** and the **→** keys simultaneously to actuate the fast forward mode (or the **run** and **←** key to actuate the fast reverse mode). The pump travels at its maximum rate while both keys are pressed simultaneously.

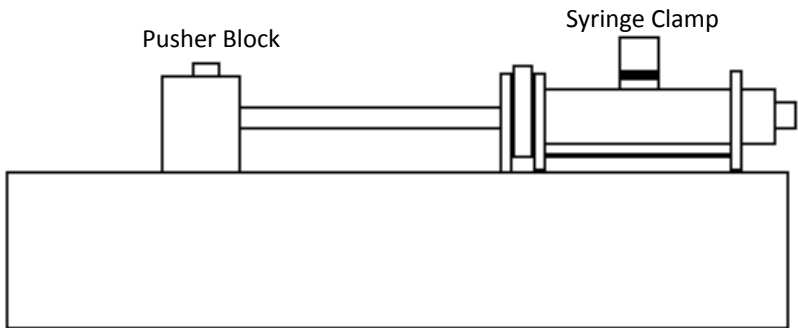
# Loading the Syringe

---

Raise the spring loaded syringe clamp and rotate away from the syringe barrel.

Using the fast forward/fast reverse feature position the pusher block so that the syringe plunger and syringe barrel will fit into the syringe holder and pusher block.

Place the syringe barrel in the V of the syringe holder, making sure that the flange of the syringe barrel is positioned between the two upright posts, and lower the syringe plunger knob into the pusher block. Rotate and release the syringe clamp to hold the syringe in place.



# NV Ram Failure

---

If the settings in the non-volatile memory become corrupted the display will read “NV Ram Failure” and the pump will not operate.

To recover from this condition the pump must be powered down and then turned on again. The pump will be re-initialized to the default settings and can now be programmed as normal.

A second method of clearing the “NV Ram Failure” is to press select and then enter a changed rate setting.

# Fuses

---

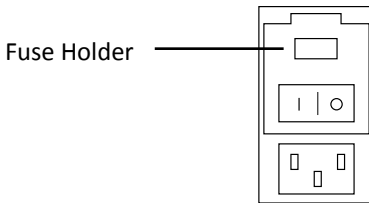
The fuses are located in the power entry module on the rear panel. The linecord must be first removed to gain access to the fuse holder.

FUSES 5x20mm, 250V~ slow blow, 0.1A

# Voltage Selector

---

If it is necessary to change the input voltage selection, disconnect the line cord from the entry module on the rear panel. Use a flat bladed screwdriver to open the Fuse Holder access door. Remove the Fuse Holder, flip over, and reinstall. Close the access door. The new input voltage selection should be visible through the door window. Install a proper line cord certified for the country of use.



# Maintenance

---

Maintenance is required only for the moving mechanical parts which should be kept clean and lubricated. Occasionally, a small amount of light machine oil should be applied to the guide rods and a small amount of grease or oil to the leadscrew.

Solvents of any type should never be used to clean the pump. A mild detergent solution may be used to clean the keypad.

# Flowrate/Syringe Diameter Table

---

**TABLE 1**

Syringe	Min $\mu$ /min	Max $\mu$ /min	700 Series Hamilton ID mm	1700 Series Hamilton ID mm
0.5 $\mu$ l	0.001	0.726	0.103	N/A
1.0 $\mu$ l	0.001	1.46	0.146	N/A
2.0 $\mu$ l	0.01	2.907	0.206	N/A
5.0 $\mu$ l	0.01	7.282	0.343	N/A
10.0 $\mu$ l	0.01	14.56	0.485	0.46
25 $\mu$ l	0.01	36.41	0.729	N/A
50 $\mu$ l	0.1	72.60	1.03	N/A
100 $\mu$ l	0.1	145.6	1.458	N/A
250 $\mu$ l	0.1	363.7	2.304	N/A

# Model Numbers

---

<b>Legacy Model</b>	<b>KDS 310 Plus</b>
<b>Order Code 110 VAC</b>	78-0311
<b>Order Code 220 VAC with CE Mark</b>	78-9311

*Notes:*

*KDS 310 Y suffix: Integrated footswitch capability.*

# Limited Warranty

---

KD Scientific Inc. warrants to the first consumer purchaser, for a period of one year from the date of purchase that this unit, when shipped in its original container, will be free from defective workmanship and materials and agrees that it will, at its option, either repair or replace the defective unit.

This warranty does not extend to misuse, neglect or abuse, normal wear and tear, accident, modification or unauthorized repair.

**KD Scientific will not be liable or in any way responsible for any incidental or consequential economic or property damage.** Some States do not allow the exclusion of incidental or consequential damages, so the above exclusion may not apply to you.

**There are no implied warranties of merchantability, or fitness for a particular use, or of any other nature.** Some states do not allow this limitation on implied warranty, so the above limitation may not apply to you.

If a defect arises within the warranty period contact KD Scientific Inc. (see address below).

The customer is responsible for shipping charges and must first obtain a Return Material Authorization number (RMA) before the unit will be accepted. If a replacement unit is issued it is covered only for the remainder of the original warranty period dating from the purchase of the original device.

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

*Note: This pump is not registered with the FDA and is not for clinical use on patients.*

Syringe pumps are manufactured by:

**KD Scientific Inc.**

84 October Hill Road

Holliston, MA 01746

phone: 508.429.6809 | fax: 508.893.0160

email: [info@kdscientific.com](mailto:info@kdscientific.com)

[www.kdscientific.com](http://www.kdscientific.com)



# ***kd*Scientific**

## **Declaration of Conformity**

---

**Manufacturer:** *KD Scientific Inc.  
84 October Hill Rd.  
Holliston, MA 01746-1388 U.S.A.  
Phone: (508) 429-6809*

We herewith declare that the following product:

**Product Name:** *Model 310 Plus Syringe Pump*

**Model Numbers:** *KD310 Plus*

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

**Application of Council Directive(s):** *2006/95/EC, 89/336/EEC*

**Standard(s) to which Conformity is Declared:**

**Safety:** *IEC 61010-1:2010 Ed. 3*

**Emissions/Immunity:** *EN 61326:1997 w/ A1:1998 and A2:2001*

*EN 61000-4-2:1995*

*EN 61000-4-3:1995*

*EN 61000-4-4:1995*

*EN 61000-4-5:1995*

*EN 61000-4-6:1996*

*EN 61000-4-11:1994*

*EN 61000-3-2:2001 w/ A.14*

*EN 61000-3-3:1995*

EMC and Safety compliance were evaluated by Intertek/ETL Semko

Reference test report file numbers: *3086793 .Box.001 & .Box.002 and 101450664 .Box.003*

**Signature:** 

Mark Davis, Director, Global MPE

**Date:** 7/29/14