

# Nanoject III

## Programmable Nanoliter Injector

INSTRUCTION MANUAL • 3-000-207



LABORATORY EQUIPMENT  
E21997

MADE  IN USA


## Rules for Safe Operation


- For indoor use only.
- Never operate unit in an explosive atmosphere.
- Do not operate unit with a damaged cord.
- Use power source only in a standard electrical outlet.
- Do not handle power source with wet hands.
- Do not put unit or power source in water or other liquid.
- When servicing, use only identical Drummond replacement parts.
- Save these instructions.

**If the equipment is used in a manner not specified by the manufacturer, the protection provided by the equipment may be impaired. Always use the power source that is supplied with the unit.**

### Connections to Power Source:

Check the power source to see that the line voltage corresponds to the voltage indicated on the mains adapter.

 If the mains adapter source and the line voltage are not compatible, the electrical components of the Nanoject III may be damaged or destroyed.

 Before each use, confirm that the mains adapter cable is not damaged, worn or severely buckled and there are no breaks in the insulating surface. If any damage is noted, do not use the Nanoject III until the damaged mains is replaced.

**Connecting to power outlet:** The control box has a power source transformer attached to the box. Plug this into your outlet using the correct adapter supplied. There is an “on/off” switch on the side of the control box which turns on the control box once the injector head is attached. To turn off, use the switch to turn off. If you want to disconnect the power from the unit, merely unplug the transformer from the wall outlet.

**Power/Current Rating:** AC 100~V, 50-60 Hz, 38VA DC9V 2A

Input: 100-240~V, 50-60 Hz, 0.6A

Output: 9V 2A

## Specifications for Usage

**This unit is intended to be used to inject nanoliter quantities of sample.**

**This equipment is for indoor use only.**

Temperature Range 10°C–35°C, Maximum Humidity 60%

**FAILURE TO USE THE EQUIPMENT IN ACCORDANCE WITH INSTRUCTIONS OR MODIFYING THE EQUIPMENT WILL VOID WARRANTIES.**

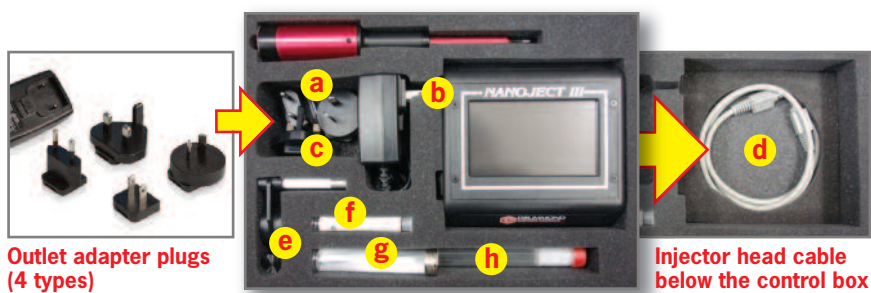
**CAUTION:** CAREFULLY READ THROUGH THIS ENTIRE MANUAL BEFORE USING YOUR NEW NANOJECT III. PAY CLOSE ATTENTION TO THE RULES FOR SAFE OPERATION WARNINGS AND CAUTIONS.

# Introduction

Thank you for purchasing the Nanoject III Automatic Nanoliter Injector by Drummond Scientific Company. This device can be used immediately after purchase, but depending on the application, will require customizing needle-shaped micropipets. Please be sure to use the included glass capillary tubes or genuine replacement glass capillary tubes. A summary of how to operate the device is provided in this quick instruction manual.

Please check the contents of your package immediately after it arrives.

## Nanoject III Unit Contents\* (#3-000-207)



- a. Main injector unit
- b. Control box (with AC adapter)
- c. Outlet adapter plugs
- d. Injector head cable (connects injector unit and control box)
- e. Universal adapter
- f. Backfilling needle (3D gauge, 2")
- g. Glass capillary tubes (3.5" long, 100 pcs., Cat. # 3-000-203-G/X)
- h. Glass capillary tubes (7" long, 100 pcs., Cat. # 3-000-203-G/XL)  
Extra green silicon seals (2) and black sealing o-rings (2) included

\***Caution:** The Nanoject III (product code: 3-000-207) does not include the accessories listed below.

### Accessories available for purchase:

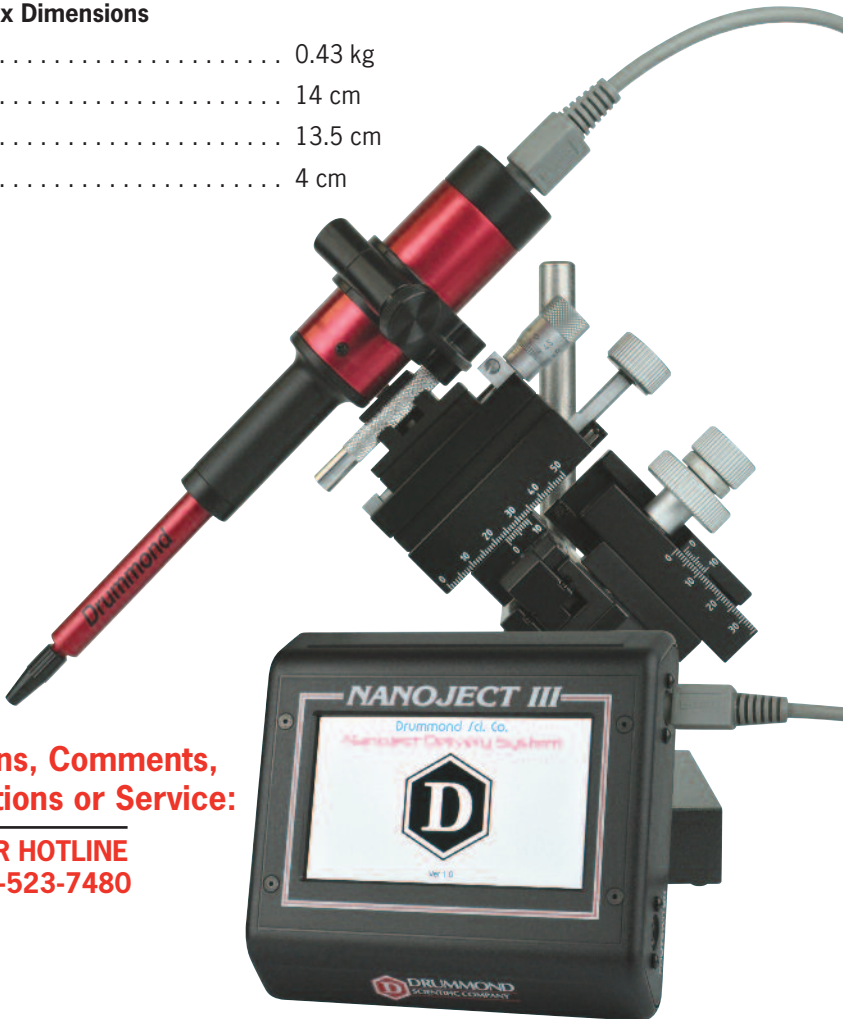
Support base	3-000-025-SB
Micromanipulator, right hand	3-000-024-R
Micromanipulator, left hand	3-000-024-L
Footswitch (remote capability for fill, empty and inject functions)	3-000-032
Silicon sealing o-rings (black, 3/pk)	3-000-030-BLK
Silicon seals (green, 3/pk)	3-000-030-S

# Technical Specifications

Part Number	3-000-207
Power Source	100/240 volt, 50/60 Hz
Total Sample Volume	4.2 $\mu$ L
Fill / Empty Volume Speed	10 nL - 200 nL/sec
Injection Volume Range	0.6 nL - 999.9 nL
Injection Rate	1 nL - 200 nL/sec
Plunger Travel	23 mm
Glass Micropipet Dimensions	OD 0.045" (1.14 mm) ID 0.021" (0.53 mm)

## Control Box Dimensions

Weight:	0.43 kg
Length:	14 cm
Width:	13.5 cm
Thickness:	4 cm



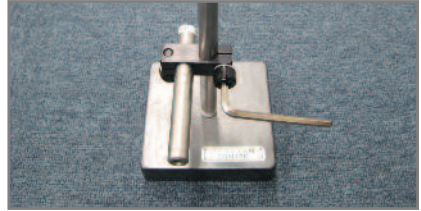
**Questions, Comments,  
Suggestions or Service:**

**CALL OUR HOTLINE  
AT 1-800-523-7480**

**Assembling the micromanipulator support base (not included)**

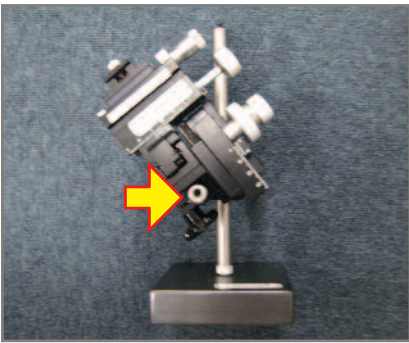


1. Attach the main pillar to the center of the square steel plate. Tighten it securely from the bottom with an Allen wrench.



2. Attach the short crossbar to the main pillar as shown in the diagram and tighten it with an Allen wrench.

**Attaching the micromanipulator to the support base (not included)**



Set the micromanipulator on the short crossbar.



(from back)



(from front)

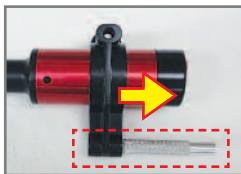
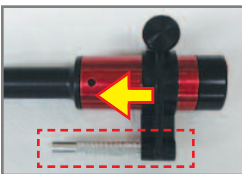
**How to install the Nanoject III Injector Head**



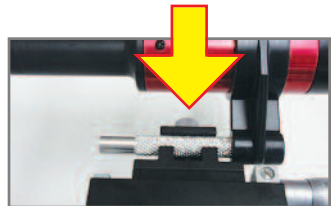
1. Insert the Nanoject III directly into the micromanipulator and tighten set screw.



2. If using the included universal adapter:



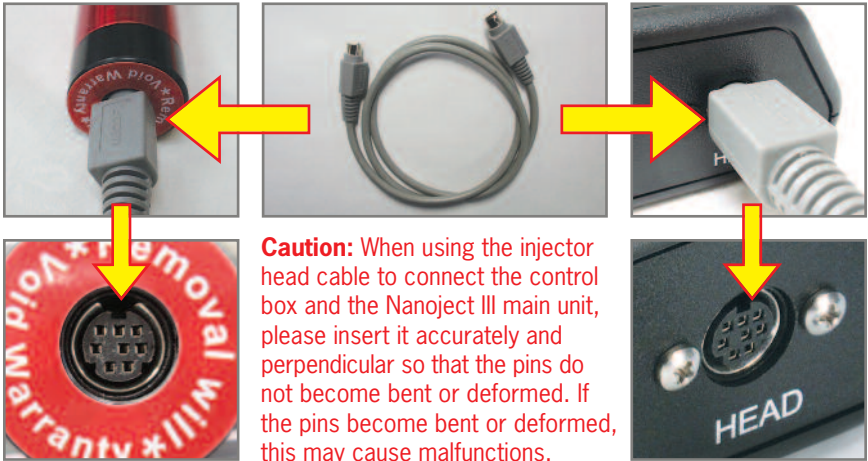
The direction of the universal adapter changes due to positional relationships with things such as microscopes and the end of the Nanoject III.



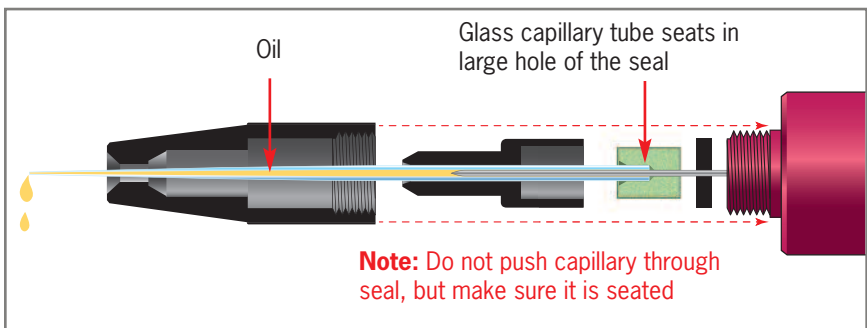
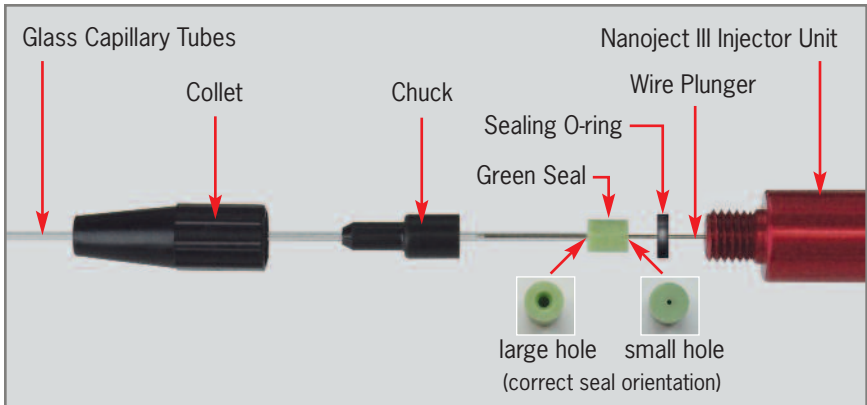
Insert the universal adapter into the micromanipulator and tighten set screw.

## Connect the Nanoject III injector unit and the control box

Use the injector head cable to connect the Nanoject III injector unit to the right side of the control box.



## How to set up glass capillary tubes (improved version)



## For Glass Capillary Tubes

To operate the Nanoject III properly, you will need to use the included glass capillary tubes when pulling micropipets, otherwise the device may not operate correctly.

## For Backfilling Micropipets

When using micropipets with glass capillary tubes, an end size range of 10 - 30 microns is ideal. The capillary tubes are made with N-51-A which softens around (780°C). Using a pipet puller, pull your tips to make the desired shape and size.

## Backfilling with Oil

Before attaching the micropipet to the injector, backfill it with oil (silicone or mineral). This can be done easily with the included backfilling needles (30 gauge, 2 inches) and syringe (not included). Alternately, a disposable spinal needle may be used.

**Caution:** If the micropipet has not been backfilled with oil it may not operate properly.



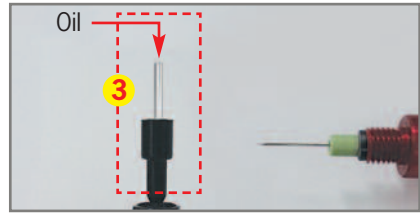
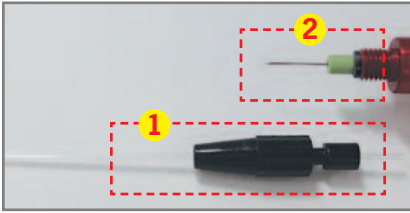
### NOTE 1:

A machine called a puller is generally used to pull the capillary tubes used with the Nanoject III.

### NOTE 2:

Before using the Nanoject III, the glass capillary tubes are filled with oil. This allows the slight movements inside the pipet to be accurately transferred to the end of the capillary tube. Types of oil generally used are silicon and mineral, although distilled water is also used in some cases.

## How to attach a micropipet



1. Slide the chuck and collet onto the glass capillary tube that has been pulled into a needle shape (photo inset 1).
2. Slide the black o-ring, then green seal onto the wire plunger, and set it as shown (photo inset 2).
3. Filling the capillary tube with oil (photo inset 3). While holding the pulled capillary tube upright, use the syringe needle (supplied) attached to a syringe filled with mineral oil, to fill the capillary tube.
4. After you have finished filling it with oil, slide the capillary tube onto the wire plunger. Gently push the collet, chuck and capillary toward the seal, pushing the capillary tube into the opening of the green seal until it seats. The chuck will seat as the collet is screwed onto the barrel. When you have tightened the collet, and have checked to make sure that the capillary tube will not come off, your preparations are complete.
5. Now, press and hold **[EMPTY]** until a beep is heard. Wipe off any excess oil that has been pushed out of the micropipet. You are now ready to fill your micropipet with sample.
6. Insert the pipet tip into your sample and press the **[FILL]** icon. The wire plunger will retract and bring with it your sample.

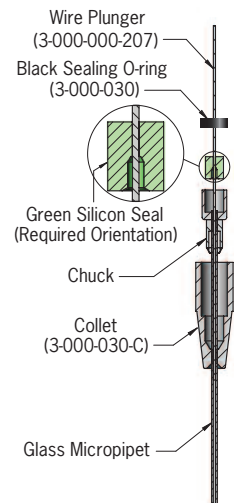
**Cleaning Instructions:** To clean the Nanoject III, simply wipe the control box down with a moist cloth. The injector head can also be cleaned with a moist cloth; unscrew the collet and wipe off the excess oil with a clean Kimwipe or soft cloth. The wire plunger may be wiped down with alcohol.

(When storing the injector, do not tighten the collet. Leave it slightly loosened.)

Orientation of the collet components is critical to the proper operation of this unit. You will see the collet contains a black “chuck” and a green “seal”. This seal has a small opening and a large opening. The small opening or hole slides over the wire plunger while the large opening or hole receives the back end of the pulled micropipet and must face the tip of the micropipet. Failure to orient this piece properly will cause an improper seal and will not enable the Nanoject III to inject properly.

When placing the backfilled micropipet on to the wire plunger and through the chuck, do not force the micropipet, merely push it onto the plunger until it bottoms out in the green seal.

Then tighten the collet to secure the pipet.



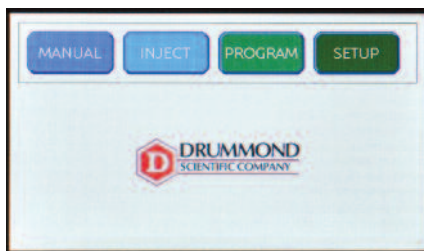


## Quick Start Guide

- 1) Carefully insert either end of the cable into the plug on the top of the injector head. Plug the opposite end of the cable into the “HEAD” port on the right side of the control box.
- 2) If using the footswitch, insert the footswitch cable into the “FOOTSWITCH” port on the right hand side of the control box.
- 3) Plug in the control box into a standard electrical outlet using the appropriate adapter head on the power supply.
- 4) Turn on unit with the on/off switch located on the left hand side of the control box.
- 5) Initially the Drummond logo will be displayed on the screen and then the operational mode screen will appear with the following icons:

Select the manual mode by pressing the **[MANUAL]** icon.

**Note:** During this brief startup phase, the injector head will automatically drive the plunger to its fully retracted position (“home”) and the control box will emit an audible beep upon completion.



- 6) Install a micropipet onto the injector plunger by first loosening the black collet slightly. Backfill your micropipet with a suitable lightweight mineral oil (or any other non-compressible liquid), and slide it onto the wire plunger until it seats firmly, then tighten the collet. It works best if the wire plunger is extended slightly so you can see what you are doing.

**NOTE: THE MICROPIPET MUST BE FILLED COMPLETELY WITH SOME TYPE OF BACKFILLING SOLUTION. THE UNIT WILL NOT INJECT ACCURATELY WITH AIR INSIDE THE MICROPIPET—THIS INCLUDES AIR BUBBLES ALSO.**

Once the micropipet is backfilled with oil and secured, press the **[EMPTY]** icon down until the plunger is fully extended (approximately 23 mm beyond the end of the black collet). A single beep will be heard when the plunger is fully extended. (This will force the backfilling solution to the tip of the micropipet and any excess will be expelled).

- 7) Front-fill the micropipet with your sample by placing the micropipet tip into your sample and pressing the **[FILL]** icon. You may want to fill at a slow speed or fill by alternately pressing the **[FILL]** icon for a few seconds and then the **[STOP]** icon to allow the sample to equilibrate before pressing the **[FILL]** again. This is dependent on the tip size and the viscosity of your sample.

**Note:** The plunger will continue to extend or retract until you press the **[STOP]** icon, or a fully extended or fully retracted position is reached.

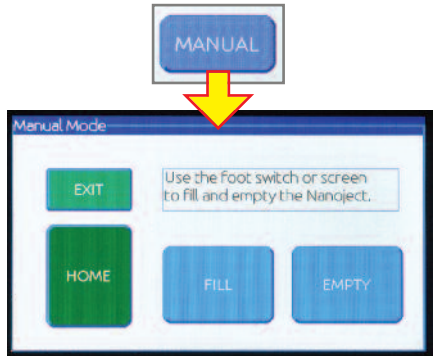
- 8) To inject the sample, return to the operational mode screen by pressing the **[EXIT]** icon, then select inject mode by pressing the **[INJECT]** icon. Set the desired injection volume (**NL**) and rate using the respective **[+]** and **[-]** icons. Press the **[INJECT]** icon to inject your sample.

**Note:** Multiple injections can be performed by simply pressing the **[INJECT]** icon again and again.

# Operational Modes

## [ MANUAL ] Mode

This mode will enable the user to manually fill and empty the micropipet. Pressing the [FILL] icon will retract the wire plunger, while pressing the [EMPTY] icon will cause the wire plunger to extend. When the [HOME] icon is pressed, the wire plunger will fully retract to the “home” position and should be flush with the end of the black collet.

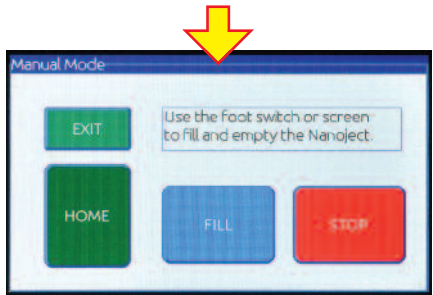


If the [FILL] or [EMPTY] icon has been pressed and you desire to stop the action, simply press the same icon position (now labeled [STOP]) a second time.

**Note:** The [HOME] and [EXIT] icons are disabled while the wire plunger is in motion.

**Note:** The speed of the fill and empty movement can be regulated in the [SETUP] mode and is independent of the injection rate.

Press the [EXIT] icon to exit back to the operational mode screen.



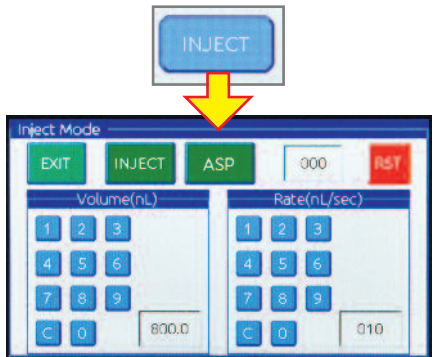
## [ INJECT ] Mode

This mode is used to do single manual injections. It enables the user to program an injection volume (0.6 – 999.9nL) and an injection rate (nL/sec) using the respective keypads. Press the [INJECT] icon to inject the desired volume at the rate selected.

To the right of the inject icon, you will see a counter box. This will count the number of injections. You can change volume and/or rate and the counter will continue to count. If you change screens, the counter will zero out. You will also see an [RST] icon that when pressed, will reset the counter to zero.

**Note:** Multiple injections can be performed by simply pressing the [INJECT] icon again and again. The injection rate is independent of the empty rate as programmed in the [SETUP] mode.

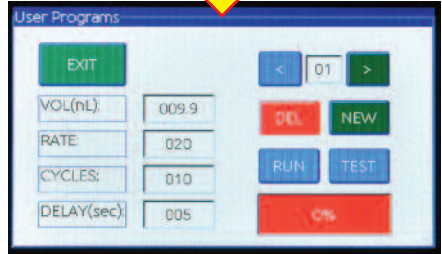
Press the [DONE] icon to exit back to the operational mode screen.





## [ PROGRAM ] Mode

This mode enables the user to program multiple injection cycle recipes. To program a new recipe, press the [NEW] icon. A screen displaying the sample injection volume (nL) and an injection rate (nL/sec) will appear. As before, adjust these individual values by using the respective keypads.



Pressing the [NEXT] icon brings up a screen displaying the number of injection cycles. Again, use the keypads to select the value desired.

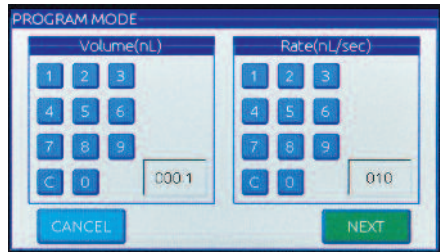
Pressing the [BACK] icon always returns you to the previously displayed screen.

Pressing the [NEXT] icon once again brings up the screen displaying the interval (secs) between injection cycles. Use the keypad to set the desired time.

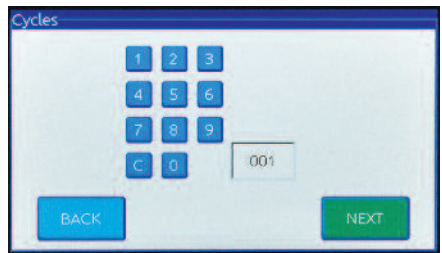
Pressing the [NEXT] icon a final time allows you to view the entire program recipe values in the following format:

**VOL (nL)** . . . . volume of injection

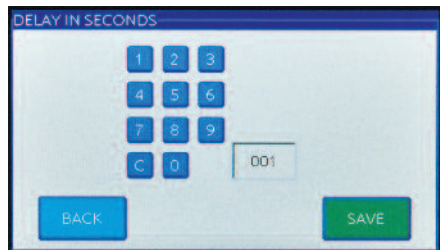
**RATE (nL)** . . . . rate of injection



**CYCLES** . . . . number of cycles this volume will be injected



**DELAY (SEC)** . . . time interval between each injection



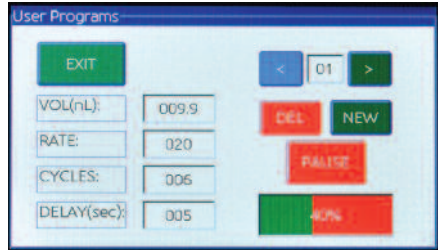
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**Note:** The program recipes are automatically saved and labelled in sequential order. You can step through the stored recipes by pressing the [**<**] and [**>**] icons. Should you desire to delete a recipe, simply press the [**DEL**] icon, and the displayed recipe will be deleted.

Pressing the [**RUN**] icon will initiate the currently displayed program recipe.

After pressing the [**RUN**] icon, a [**PAUSE**] icon appears and enables the user to interrupt the program at any time, and then resume the program where it was interrupted by pressing the [**RUN**] icon again.

To initiate a single cycle of the displayed recipe, simply press the [**TEST**] icon once.

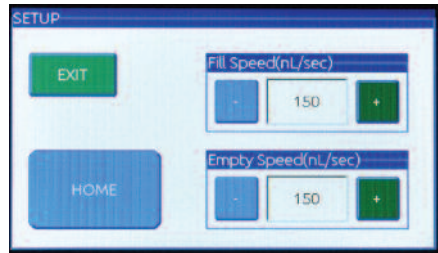


Below the [**RUN**] icon is a box displaying the number of injection cycles remaining in the entire program recipe. It will count from (0) as the multiple injection cycle progresses. Below this “counter” box is a display of the percentage of the program recipe remaining. It will count from 0% to 100% as the multiple injection cycle progresses, until complete.

Press the [**EXIT**] icon to exit back to the operational mode screen.

## [**SETUP**] Mode

This mode will enable the user to program and store the manual fill and empty rates. As before, use the [**+**] and [**-**] icons to select the desired independent values for both the FILL SPEED (NL/SEC) and the EMPTY SPEED (NL/SEC).



**Note:** As mentioned earlier, the fill and empty speeds on this screen have no effect on the injection rate.

Press the [**HOME**] icon to manually retract the plunger to the “home” position.

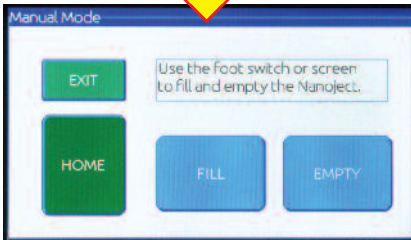
Press the [**EXIT**] icon to exit back to the operational mode screen.

# Footswitch Operation

## [ **MANUAL** ] Mode

In this mode, the micropipet is manually filled or emptied.

Touch the [**MANUAL**] icon to go to the MANUAL MODE screen in the diagram below.

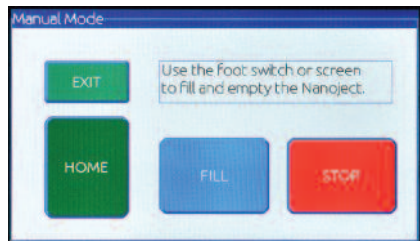


## **EMPTY** Function

When you touch this icon and the icon changes to a red [**STOP**] icon, the motor continues to empty the micropipet.

When the plunger has extended completely (approximately 23 mm from the end of the collet), there will be a beeping sound and the screen will return to the [**EMPTY**] icon at the same time.

To stop it in the middle, push [**STOP**].



The one-touch functions such as [**EMPTY**] and [**FILL**] cannot be done with the footswitch. The same phenomenon will occur if you continue to push the pedals for functions such as [**EMPTY**] and [**FILL**]. If you ease the pressure off the pedal, the motor will stop.

# Footswitch Operation

## [INJECT] Mode

On this screen, in MANUAL mode, enter the injection conditions.

When you touch the **[INJECT]** icon, it will go to the next screen.

Enter the manual **[INJECT]** conditions.

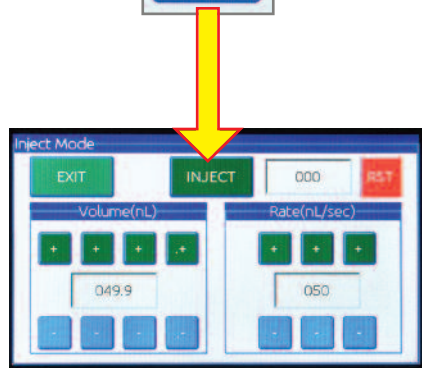
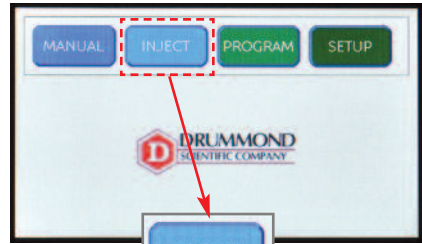
[VOLUME (NL)] = Within the range of 0.6-999.9 nL, in increments of 0.1 nL

[RATE (NL/SEC)] = Injection speed within the range of 10-200 nL/sec, in increments of 1 nL

When setup is finished, the green **[INJECT]** icon starts injection.

One push (push all the way)=one shot, then it will change to a yellowish green **[INJECT]** icon, and there will be a beeping sound when it is finished.

**[EXIT]** Goes back to the operation screen.



When using **[INJECT]** with the footswitch, please continue to push the pedal until you hear the beeping sound.

The motor is still in operation until you hear the beeping sound.

If you ease the pressure off the pedal before you hear the beeping sound, the motor will stop and the set volume will not be injected.

In this mode, the **[FILL]** and **[EMPTY]** pedals are disabled.

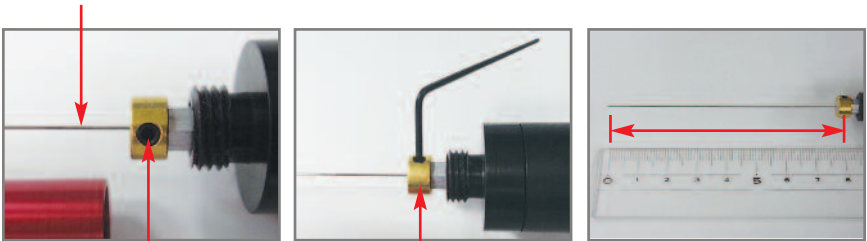
# Replacing Wire Plunger

(user function)



1. Unscrew red aluminum barrel and remove.
2. This will expose the wire plunger, brass collar, and Allen set screw.

Wire Plunger (3-000-000-207)



Allen Set Screw

Brass Collar

3. Loosen one (1) Allen set screw slightly and remove the wire plunger.
4. Insert a new plunger until it bottoms out, and tighten the Allen set screw.



5. Replace the aluminum barrel. Replace the black o-ring, green seal, chuck and collet.
6. Make sure the green seal is properly oriented (see page 6).

### 3-000-207 kit contains the following items:

Control box & power source . . . . .	3-000-037
Injector head . . . . .	3-000-030-B
Injector head cable . . . . .	3-000-031
100 pcs., 3.5" glass capillaries . . . . .	3-000-203-G/X
100 pcs., 7" glass capillaries . . . . .	3-000-203-G/XL
Backfilling needle . . . . .	3-000-027
Universal adapter . . . . .	3-000-024-A
Extra green silicon seals (2) and black sealing o-rings (2) included	

### Accessories not included in kit:

Replacement collet kit . . . . .	3-000-030-K
(1 collet, 1 chuck, 1 seal, 1 wire plunger, 1 Allen wrench)	
Replacement collet only . . . . .	3-000-030-C
Replacement silicon seal (3 pk) . . . . .	3-000-030-S
Replacement wire plunger . . . . .	3-000-000-207
(Note: Not the same as the Nanoject II plunger)	
Support base . . . . .	3-000-025-SB
Micromanipulator, right hand . . . . .	3-000-024-R
Micromanipulator, left hand . . . . .	3-000-024-L
Footswitch . . . . .	3-000-032
(remote capability for fill, empty and inject functions)	
Silicon sealing o-rings, (black, 3/pk) . . . . .	3-000-030-BLK
Silicon seals (green, 3/pk) . . . . .	3-000-030-S

**Questions:** Please contact Drummond at **800-523-7480**.



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