



eVol[®]

Every One an Expert



⚠ WARNING

Only trained laboratory personnel that have read this manual and the warnings and cautions contained in it should operate the eVol®.

⚠ WARNING

When handling an eVol® extreme care should be taken to avoid potential injury from the needle.

⚠ WARNING

For safety, it is recommended to only install the syringe when performing liquid handling operations. It is recommended to remove the syringe for all other functions.

Thank you for purchasing the eVol® Automated Analytical Syringe.

You now have the **ability to automate a manual process!** You will experience the excellence of eVol® incorporating new features not found in any other hand-held positive displacement device. This device provides true innovation and technology to any liquid handling procedure.

ENABLED BY XCHANGE®

Your eVol® is enabled by XCHANGE®: A unique coupling system that allows dispensing devices and tools to be quickly and conveniently changed. The XCHANGE® coupling integrated into your eVol® system allows the specially designed analytical syringes to be changed with ease.



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1 UNIQUE FEATURES

Your new eVol® employs an **easy-to-use** touch wheel controller with intuitive programming to offer **higher throughput** dispensing.

Your eVol® also features:

- Ergonomic design with light-weight components.
- A large digital multi-color display and intuitive touch wheel menu selector.
- Program navigation using a touch wheel controller.
- One handed (left or right) operation.
- User selectable function or step-based programming modes.
- Calibration for enhanced accuracy at target volumes or with varying liquid types.
- Calibration reminder prompts.
- Memory space for storage of service data records.
- Rechargeable, long-life, lithium-ion battery that has a capacity of 1050 mAmp/hours.
- Automatic display dimming and power-off after a configurable duration (5 minutes, by default) to extend battery life.
- Universal Power Supply (wall plug-in) that allows the eVol® to be used while charging the battery.





2 GETTING STARTED

Getting started with your eVol® Automated Analytical Syringe involves a few **easy steps**.

1 PARTS CHECKLIST

Before using your eVol® Automated Analytical Syringe, please verify that you have the following:

eVol® Electronic Syringe Starter Kit

- eVol® Automated Analytical Syringe
- Battery (located inside the eVol®)
- 5 µL eVol® XCHANGE® Syringe supplied fitted with 50 mm needle
- 50 µL eVol® XCHANGE® Syringe supplied fitted with 50 mm needle
- 500 µL eVol® XCHANGE® Syringe supplied fitted with 50 mm needle
- Manual
- Quick Start Guide
- Support CD
- Multi-Country Charger
- Storage Stand

eVol® NMR Edition

- eVol® Automated Analytical Syringe
- Battery (located inside the eVol®)
- 5 µL eVol® XCHANGE® Syringe supplied with 115 mm long needle
- 50 µL eVol® XCHANGE® Syringe supplied with 115 mm and 180 mm long needles
- 500 µL eVol® XCHANGE® Syringe supplied with 115 mm and 180 mm long needles
- Manual
- Quick Start Guide
- Support CD
- Multi-Country Charger
- Storage Stand

If you do not have all of these items, contact the company that supplied your eVol® or contact your nearest SGE office directly.

2 REGISTER WARRANTY

Please fill out the warranty registration form on the SGE eVol® website: www.sge.com/eVol

3 CHARGE THE BATTERY

Your eVol® uses a lithium-ion battery that has a capacity of 1050 mAmp/hours. It is recommended to charge the battery for at least 1 hour before using. A **full charge takes 2.5 hours** and will provide approximately 3500 dispensing cycles.

Refer to Battery Charging and Information in Section 5 for details. A battery indicator is provided on the eVol® display. The battery indicator segments flash while charging. When fully charged, the battery indicator becomes green.



2 GETTING STARTED

4 TURN ON eVol®

After the battery is fully charged, press and release the RUN button to turn on eVol®.

Your eVol® is now ready to be used.

⚠ CAUTION

Before operating your eVol® carefully read the instructions and warnings in this manual.

TIP

The display reflects the menu shown when the eVol® was factory-set (Main Menu) or last used. If the eVol® was used previously, the display may not show the Main Menu. Press the Back button (↩) as many times as necessary to return to the Main Menu.



TURN OFF eVol®

To turn off your eVol®, press and hold ↩ for 3 seconds.



TIP

The display will dim and the eVol® will turn off automatically after a preset duration of inactivity. This duration is 5 minutes, by default, and configurable with the Toolbox menu (see Section 10.6.1, Preferences).

3 USER INTERFACE

- A** Display
- B** Back Button
- C** Touch Wheel
- D** ◀ ▶ Left and Right Navigation (Selection) Buttons
- E** OK (Enter) Button
- F** Purge/Prime Button
- G** Run Button
- H** Finger Hook
- I** Power Connector
- J** Reset Button
- K** Charging Stand Interface
- L** Battery
- M** XCHANGE® Coupling



3 USER INTERFACE

3.1 DISPLAY AND MENUS

The screen is divided into sections depending on the operation being performed.

eVol[®] incorporates a distinctive 38 mm (1.5 inch) multi-color display. The screen shows all the menu selections, programming actions, indicators and help screens. The display lists the current mode, instructions, options and volumes. It also may show information about an operation. For example, the top line always displays the current mode along with the status of the battery.



3.2 BUTTONS AND CONTROLS

3.2.1 TOUCH WHEEL

eVol® uses a touch wheel incorporating **5 command buttons**:

- 1** Back Button, ⇐⇒.
- 2** OK (or Enter) Button.
- 3** Two Navigation Buttons, ◀ and ▶, used to make selections.
- 4** Purge/Prime Button.
- 5** RUN Button.



The touch wheel is fully operational with only one hand (right or left). Rotational finger movements on the touch wheel translate into up and down cursor movement on the display. This allows you to scroll to a specific volume quickly with only 3 revolutions of the wheel.

1 Back Button

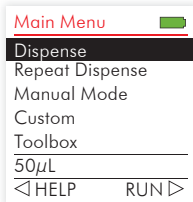
This button enables you to navigate backward through the menu screens or to escape from any programming screen.

2 OK Button

Spin the touch wheel to choose (and highlight) an option on the display. Then, press OK to make the selection.

3 Navigation Buttons ◀ ▶

At times, you will see ◀ and ▶ at the bottom of a display screen. For example:



These buttons/arrows are used to select options. Press ◀ to select the option indicated with the left arrow (HELP, in the example). Press ▶ to select the option indicated with the right arrow (RUN, in the example).

4 Purge/Prime Button

The function of this button will depend on the current status of eVol® when it is pressed.

- If the button is pressed while there is liquid in the syringe the Purge function is initiated. This will empty the syringe.
- If the button is pressed when there is no liquid in the syringe the Prime function is initiated. This will prime the syringe by cycling the plunger.

5 Run Button

Press and release the RUN button to execute the selected dispense operation. This button is centrally located for left or right-handed actuation. Use of the Run button for special dispensing functions is described for those functions in Section 10.2, Editable Program Variables.

3.2.2 RESET BUTTON

The reset button is located on the rear of the eVol® (see image below). When reset, the programs stored in memory are maintained. Reset will only reset the firmware. All user settings are stored in non-volatile memory which is not reset when the reset button is pressed.

Once pressed, the startup screen will be displayed. Press RUN button to continue and allow the instrument to initialize and home the syringe (Homing). The routine ends by displaying the Main Menu.

3.2.3 FINGER HOOK

The finger hook facilitates easy operation with your preferred hand.



Homing

“Home” is the zero volume position. It is the base point for the installed syringe and is determined by driving the syringe plunger to its maximum extent and then retracting it past a sensor. The information collected during this process is used to determine the zero position for the plunger. The zero position is saved as a parameter for each individual syringe.

Beep Tones

The eVol® has simple tones to indicate completion of operations and errors. Optionally, with the Toolbox function, you can turn off the beep tones (refer to Section 10.6.1, Preferences).

Multi-Language Help

Language-specific help files for eVol® are available from the Toolbox menu option. (For more information about language selections, refer to Section 10.6.4)

Available help languages are:

- English (default)
- French
- German
- Japanese
- Simplified Chinese
- Spanish

5 BATTERY CHARGING AND INFORMATION

eVol® uses a Lithium-ion rechargeable battery that has a capacity of 1050 mAmp/hours. Battery charging can take place in 2 ways, using:

- eVol® Single Position Charging Stand (Part Number 2910030).
- Wall plug-in Universal Power Supply that allows for use while charging the battery. This unit is supplied with eVol® kits and can also be purchased separately (Part Number 2910012).

TIP

eVol® can be run even with a depleted battery. The Universal Power Supply can be used to run the unit from an AC voltage source. It will take approximately 30 seconds of charging before you can use your eVol®.

A fully charged battery allows approximately 3500 dispensing cycles. A full (100%) charge requires 2.5 hours. The battery is 80% charged in 1.3 hours. Battery life is indicated on the display. The battery indicator segments flash while charging. When fully charged, the battery indicator changes to solid green.

TIP

It is recommended the battery be replaced after it has been recharged more than 500 times.

5.1 CHARGING THE BATTERY ON THE OPTIONAL CHARGING STAND

Place the eVol® on the charging stand by hooking the charging stand interface (Page 6 'K') on the eVol® over the two-prong connector on the stand.

When eVol® is placed on the charging stand it will be switched on:

- The battery life indicator blinks to indicate the battery is charging. Once a full charge is achieved, the battery life indicator changes to solid green. *After being placed on the stand eVol® will dim and switch off according to the preset dimming and turn-off periods.*

To disconnect eVol® from the stand, simply lift it from the stand:

- If eVol® is off, press the RUN button to turn it on. The Startup screen will flash and the appropriate homing routine will occur.
- The battery indicator will now become static. If eVol® is fully charged and the indicator is solid green, it will now become three grey bars indicating a full charge.



**Single Position eVol®
Charging Stand**
Part No 2910030

5.2 CHARGING THE BATTERY WITH THE UNIVERSAL POWER SUPPLY (UPS)

With the Universal Power Supply (UPS), you can use eVol® while charging. Select and fit the appropriate mains plug adaptor to the UPS. Ensure the adaptor is correctly fitted so the eVol® charges properly. Insert the charging plug into the power connector on the eVol® (Page 6 'I'). Plug the UPS into a mains power supply.

When the line cord is connected eVol® will automatically switch on:

- The current screen remains displayed.
- The battery life indicator blinks continuously to indicate the battery is charging. If eVol® is idle while charging, the display will dim (described more in Power and Display Dimming (Idle), Section 10.6.1), but it will continue to show the battery life indicator.
- Once a full charge is achieved, the battery life indicator changes to solid green.

When disconnecting eVol® from the charger:

- If eVol® is off when disconnected, press the Run button to turn it on.
- The battery life indicator will appear as static grey bars.



⚠ CAUTION

USE ONLY AN APPROVED POWER SUPPLY OR CHARGE STAND.
Use of an incompatible power transformer will damage eVol®.

Power supply input/output specifications are:

Input: 100-240V, 50/60Hz, Output: 6V, 0-1.75A (SET AT 0.5A).

6 WARNINGS & CAUTIONS

Use of eVol® does not pose risk of personal injury or equipment damage when the unit is handled and cared for as described in this manual. Warnings and cautions are listed through the manual and summarized here:

WARNING

Only trained laboratory personnel that have read this manual and the warnings and cautions contained in it should operate the eVol®.

WARNING

When handling an eVol® extreme care should be taken to avoid potential injury from the needle.

WARNING

For safety, it is recommended to only install the syringe when performing liquid handling operations. It is recommended to remove the syringe for all other functions.

CAUTION - LIQUIDS

Do not immerse eVol® in liquid. The fluid can damage internal parts.

CAUTION - AUTOCLAVING

Do not autoclave the entire unit. The extreme heat can damage the display and other electrical components. Only the eVol® syringes can be autoclaved (refer to instructions supplied with eVol® syringes).

⚠ CAUTION - BATTERY

USE ONLY AN SGE APPROVED BATTERY:
Part No.: 2910040 (Li-ion, 3.6 V, 1,050 mAh).

⚠ CAUTION - POWER

Always turn off power and unplug the Universal Power Supply (UPS) before cleaning the exterior.

⚠ CAUTION - CHEMICAL COMPATIBILITY

Your eVol® handset is not compatible with all liquids. Ensure it is placed in the stand when not in use and avoid contact with organic liquids.

⚠ CAUTION - UNIVERSAL POWER SUPPLY (UPS)

A Universal Power Supply (UPS) can be used to charge or run the eVol®. Use only the Universal Power Supply or charging stand offered by SGE Analytical Science. Use of an incompatible universal power supply can damage eVol®.

Power supply input/output specifications are:

- Input: 100-240 V, 50/60 Hz
- Output: 6 V, 0-1.75 A (set at 0.5 A)

7.1 INTRODUCTION TO eVol® SYRINGES



The syringes used with eVol® are enabled by XCHANGE® technology which allows them to be quickly and conveniently changed.



For ease of identification eVol® syringes are color coded according to their maximum capacity. The color coding of the eVol® Syringes conforms to SGE’s Syringe Color-Code Identification System.

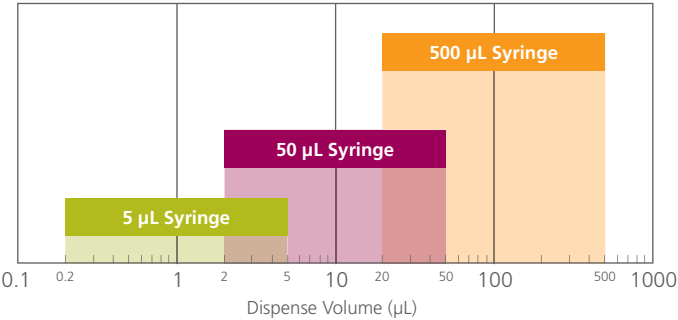
The color coding and volume range of the three standard eVol® Syringes are per this table:

Syringe Capacity (µL)	Volume Range (µL)	Scale Length (mm)	Color Code
5	0.2 - 5	25.4	Green
50	2 - 50	25.4	Purple
500	20 - 500	25.4	Orange

Table 1. Standard syringes and recommended volume ranges

The following chart is logarithmic and demonstrates the volume range and overlap of the standard syringes

supplied with the kit. Table 1 should be used when selecting a syringe that is compatible with the volumes that will be aspirated and dispensed.



All eVol® syringes can be calibrated to provide greater dispensing accuracy. Syringe calibration should be performed by an experienced user or by an external company depending on your laboratory protocols. Every eVol® syringe has a unique identifier which is used to identify the syringe when selecting it and more importantly when calibrating the syringe.

TIP

It is recommended that a different eVol® syringe is used for each liquid dispensed. This will minimize the time required for priming the eVol® syringes when the liquid to be dispensed changes. It also will provide maximum efficiency when using your eVol® system and will ensure no carry-over or cross-contamination occurs between the dispensed liquids.

Replacement syringes and plungers are available. See list below for part numbers.

Syringe Capacity (µL)	Replacement eVol® Syringes	Replacement Plunger Part Number
5	2910020	2910380
50	2910022	2910382
500	2910024	2910384

7.2 INSTALLING AND REMOVING A SYRINGE

To insert a syringe push the front collar of the XCHANGE® coupling upwards. Hold the collar in this position whilst inserting the back (plunger end) of the syringe into the bottom of the instrument. Ensure the plunger is at zero position.

To remove a syringe follow the same procedure, then pull on the syringe to disconnect the plunger button from the electronic drive.

7.3 ADD A SYRINGE

This function allows you to quickly and simply add up to 10 syringes that can be subsequently used with eVol®. Before a syringe can be used it must be added to the list of available syringes.

This is useful when using multiple syringes of the same volume for handling different liquids. Each individual syringe can be calibrated and saved with an identifier as to which liquid it should be used with.

The table on page 17 shows a list of the standard syringes and their allowable volume range. All standard syringes have a 25.4 mm or 1 inch scale length. The syringe capacity is printed on the eVol® Syringe.

7.3.1 ADDING A SYRINGE

To add a syringe, use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Syringe option and then select the Add option from the Syringe menu (Figure 1).

A list of available syringe volumes will be displayed. Use the touch wheel to select the syringe volume and press the OK button (middle button) to add the syringe. The syringe details are displayed. (Figure 1). A syringe method must be selected in order for the new syringe to be saved. To save the syringe once all details are correct press ▷.

The syringe details can be edited as described in the next section.

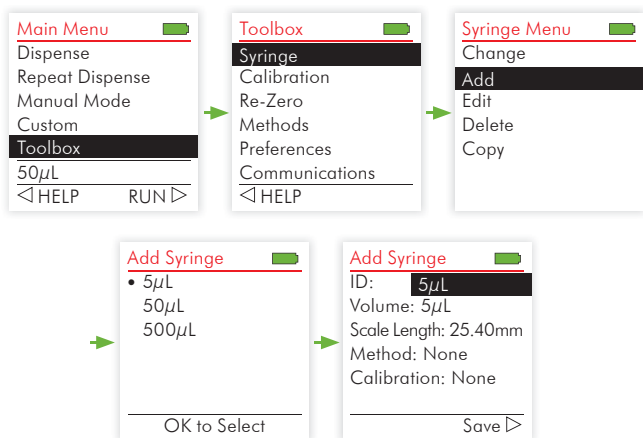


Figure 1. Adding a syringe.

7.4 EDIT SYRINGE DETAILS

To edit the details of a saved syringe, use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Syringe option and then select the Edit option from the Syringe menu.

A list of saved syringes will be displayed. Use the touch wheel to select the syringe volume and press \triangleright to edit the syringe. The syringe details are displayed (Figure 2).

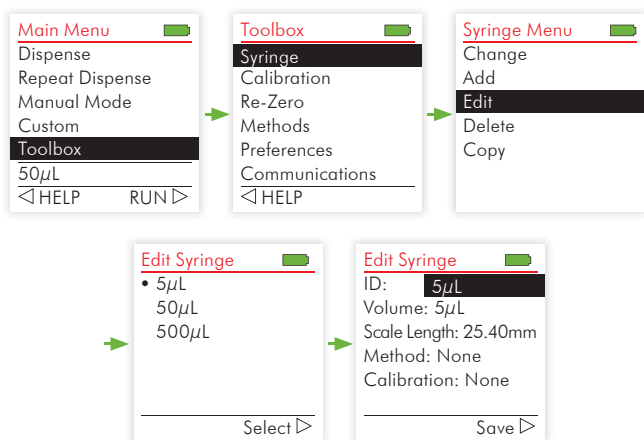


Figure 2. Editing a syringe.

7.4.1 EDITING THE SYRINGE DETAILS

The syringe details that can not be edited are shown in blue.

Detail	Data/Origin
ID	Enter a short name, unique identifier, or description to help identify this syringe (examples: MEOH, ACN, DMSO,R1,A1).

Volume	The volume cannot be edited on standard syringes.
Scale Length	The scale length cannot be edited on standard syringes.
Method	Enter the default syringe method to use with this syringe.
Calibration	This is the calibration factor for the syringe. When adding a new syringe 'None' is displayed. The calibration factor cannot be edited in this section and can only be edited through the syringe calibration option (see Section 9).

Table 2. Editing syringe details.

Editing the Syringe ID

To edit the syringe ID, select ID from the list using the touch wheel and press OK (middle button). An alphanumeric input screen is displayed. Enter the desired ID by using the touch wheel to scroll the cursor over the desired character and pressing the OK button to select. Press Save ▷ once and the ID has been entered (Figure 3).

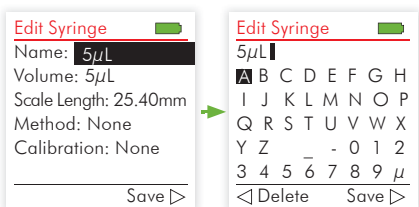


Figure 3. Editing the syringe name.

TIP

Saving used syringes with unique identifications may make selecting syringes from a list simpler.

TIP

Use a permanent marker to write the syringe name on the colored strip on the syringe. This will make it simple to identify the different syringes.

7.5 DELETING A SAVED SYRINGE

To delete a saved syringe, use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Syringe option. Then select the Delete option from the Syringe menu and press OK.

A list of saved syringes will be displayed. Use the touch wheel to select the syringe to delete and press \triangleright to select. A confirmation is shown on the screen and press \triangleleft Yes or No \triangleright (Figure 4).

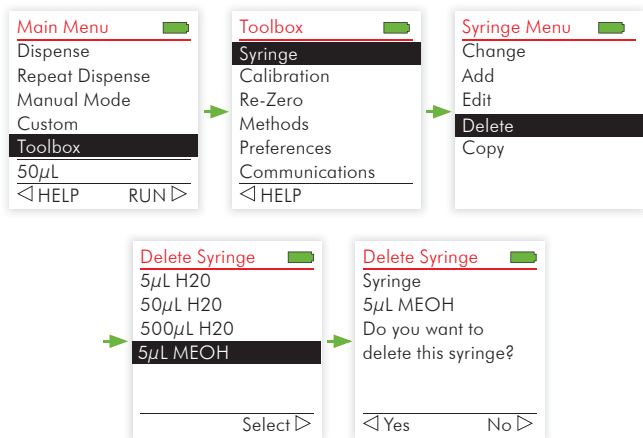


Figure 4. Deleting a saved syringe.

7.6 CHANGING A SYRINGE

This function lets you quickly and simply change syringes from a list of up to 10 previously added syringes. When a syringe is selected from the list, the stored parameters for that syringe, including the syringe method, are loaded and used as the default values.

When a syringe is calibrated the calibration factor is saved with the syringe details. When a syringe is changed the calibration factor for the selected syringe is loaded with the other syringe details.

7.6.1 CHANGING A SYRINGE

There are two ways the syringe can be changed.

1 Selecting Change Syringe through the Quick Access Menu. Choose Dispense from the Main Menu, then from the Run Dispense window use the touch wheel to select Change Syringe from the blue Quick Access Menu (Figure 5).

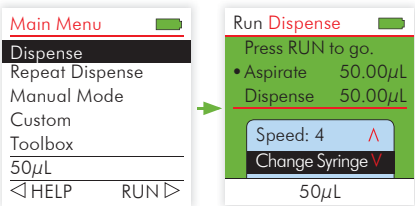


Figure 5. Selecting Change Syringe through the Quick Access Menu

2 Selecting Change Syringe through the Toolbox Menu. Use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Syringe option and then select the Change option from the Syringe menu (Figure 6).

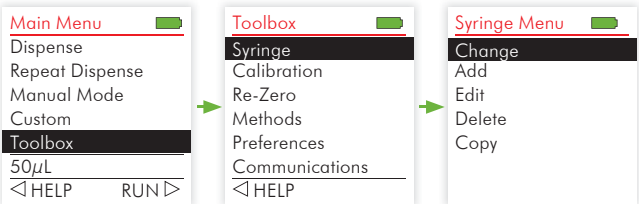
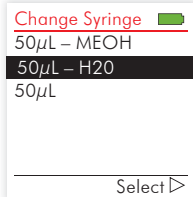
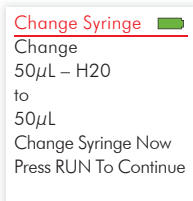



Figure 6. Selecting Change Syringe from the Toolbox Menu

7 SYRINGES



When the Change Syringe option is selected all of the currently available syringes are listed. The syringe list is displayed in a format that includes the volume of the syringe followed by a dash and the syringe ID.




Using the touch wheel select the syringe you want to change to and press . The plunger will travel back until the plunger is fully extended to allow it to be conveniently disconnected from the magnetic plunger coupling. A message will prompt you to change the syringe.

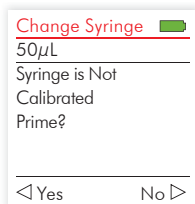


To change the syringe push the front collar of the XCHANGE[®] coupling upwards, while holding the collar in this position remove the syringe. To insert the new syringe follow the same procedure.

Press the RUN button.

If the syringe has been previously homed the plunger is moved to the home position. If the syringe has not previously been homed the Syringe Re-zero/Homing procedure is automatically initiated. See Section 7.6 for details on the syringe Re-zero/Homing procedure.

 **WARNING**
When handling an eVol[®] extreme care should be taken to avoid potential injury from the needle.



If the syringe has been previously calibrated the calibration factor is downloaded with the syringe details. If the syringe has not previously been calibrated a reminder prompt will be displayed. To achieve the best performance from eVol® it is recommended the syringe is calibrated before use. The calibration procedure is explained in Section 9.

Finally, you will be prompted to Prime the syringe. Press \triangleleft Yes to prime the syringe or \triangleright No to skip the prime function. See Section 7.8 for description of the syringe priming procedure.

7.6.2 COPYING A SYRINGE

Use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Syringe option and then select the Copy option from the Syringe Menu.

When the Copy option is selected all of the currently available syringes are listed. The syringe list is displayed in a format that includes the volume of the syringe followed by a dash and the syringe ID. Using the touch wheel select the syringe you want to copy and press \triangleright to select.

7 SYRINGES

Finally, you will be prompted to copy the syringe. Press \triangleleft Yes to copy the Syringe or \triangleright No to escape (Figure 7).

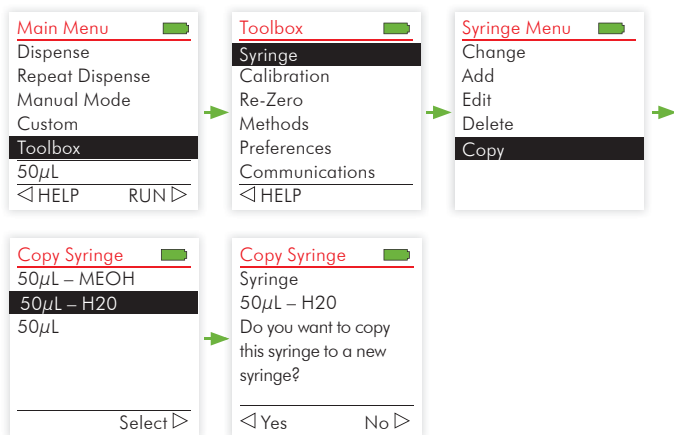


Figure 7. Copying a syringe using the Toolbox menu

7.7 RE-ZERO THE SYRINGE (HOMING)


As each syringe and plunger is slightly different it is necessary to home the syringe to gain maximum performance from eVol®. The re-zero procedure uses a series of plunger movements and sensors to find the correct zero position for the syringe plunger. The re-zero procedure is sometimes referred to as homing the syringe. The zero position is stored with the syringe details and is recalled every time the syringe is used so there is no need to home the syringe every time it is used.

There are 2 ways to re-zero a syringe:

1 Automatic Syringe Re-zero

A re-zero (homing) routine will be automatically performed the first time a syringe is used. When changing to a syringe that has no zero position saved with the syringe details, a re-zero routine will automatically be performed and the zero position saved.

2 Manual Syringe Re-zero

From time to time it may be advisable to manually re-zero the syringe. This can be achieved through the Toolbox menu option. To manually re-zero a syringe, use the touch wheel to select the Toolbox menu from the Main Menu. From the Toolbox menu select the Re-zero option and press the OK button. Press the RUN button to execute the homing routine, pressing the back  button will exit without homing the syringe (Figure 8).

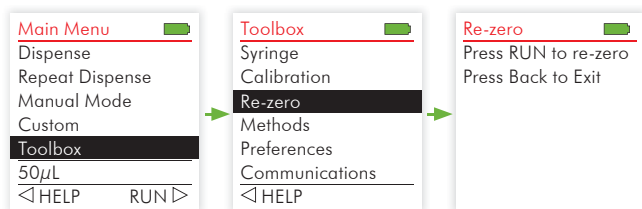
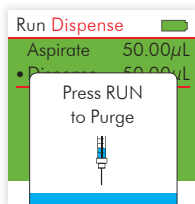



Figure 8. Manual Re-zeroing (Homing) of Syringe

7.8 PURGING THE SYRINGE



A program can be terminated by pressing the Purge/Prime button. In these cases, or when a program is terminated for other reasons, there may be liquid remaining in the syringe.



When this occurs you will be prompted to purge (dispense) the liquid from the syringe before continuing. To purge the liquid from the syringe, position the syringe needle in a suitable container and press the RUN button. Upon completion of the liquid purge function, the first step in the current program will be displayed. To cancel the purge option and continue running the program, press the back  button.

7.9 PRIMING THE SYRINGE

In a laboratory it is common practice to prime a syringe whenever the liquid to be dispensed changes. Priming replaces the liquid already in the syringe with the new liquid to be dispensed. This is achieved by aspirating and dispensing the new liquid several times. Priming is also useful to remove air bubbles from a dry syringe.

Your eVol® system has an automatic priming procedure that can be used whenever the liquid to be dispensed is changed.

To accommodate the various liquids that will be dispensed with eVol® a convenient means of selecting appropriate priming conditions has been included. Priming parameters are stored with the syringe methods that can be allocated to each of the syringes so that the priming conditions are compatible with the liquid to be aspirated with the syringe. See Section 8 Syringe Methods for details.



To prime the syringe press the Purge/Prime button. If there is liquid in the syringe this function will first Purge the liquid from the syringe. If this is the case pressing the Purge/Prime button a second time will prime the syringe. If there is no liquid in the syringe when the Purge/Prime button is pressed the syringe will be primed.



In some cases the prime sequence will not be able to fully remove all air bubbles from the syringe this is due to a limitation on the maximum speed the electronic drive unit can achieve. In these cases it is recommended that the syringe is to be removed and manually primed to remove all air bubbles.

8 SYRINGE METHODS

8.1 SYRINGE METHODS OVERVIEW

Your eVol® can be used to aspirate and dispense liquids of varying viscosities.

As the viscosity of a sample increases, the flow rate of liquid into the syringe needs to decrease to prevent cavitation of the liquid. Cavitation causes unwanted bubbles in the liquid and occurs when the pressure in the syringe falls below the vapor pressure of the liquid.

The aspiration flow rate is affected by two parameters: the speed of the plunger movement and the capacity, or more specifically the cross sectional area, of the syringe. At the same speed setting, a 500 μL syringe will aspirate liquid at a flow rate 100 times more than a 5 μL syringe. For larger volume syringes, slower speed settings should be set.

The ability to save and load individual syringe methods provides quick and easy access to specific default parameters when the sample is affected by increased viscosity. Each syringe can be associated with a different 'Syringe Method' (see section 8.2). Each time a particular syringe is installed, its exclusive parameters are loaded as its defaults.

8.2 ADDING A SYRINGE METHOD

Use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Methods menu and then select the Add option. Select the syringe volume that you would like the method to be used with (Figure 9).

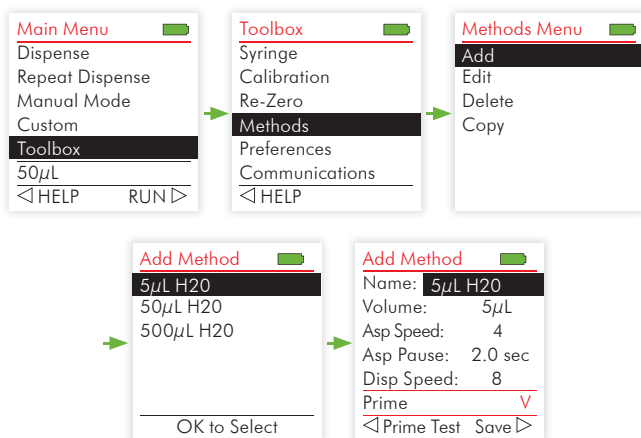


Figure 9. Adding a Syringe Method.

8 SYRINGE METHODS

Set the name and other parameters for the method. The parameters that can be set and saved in a syringe method are shown in Table 3.

Method Parameters	Method Parameter Limits
Syringe	The syringe capacity suitable for this method.
Method Name	A Syringe Method name of up to 15 characters. (e.g. DCM 5UL)
Aspirate Speed	1 to 10
Aspirate Pause	0 to 60 (pause that occurs before the aspirate starts)
Dispense Speed	1 to 10
Prime Volume	Available volume range of the associated syringe.
Prime Aspirate Speed	1 to 10
Prime Aspirate Pause (sec)	0 to 60 (pause that occurs before the aspirate starts)
Prime Dispense Speed	1 to 10
Prime Dispense Pause (sec)	0 to 60 (pause that occurs before the prime dispense starts)
Prime Cycles	1 to 30

Table 3. Syringe Method Settings

TIP

When selecting a name for a syringe method consider using an identifier for the liquid and syringe capacity the parameters are intended to be used with. For example a syringe method name DMSO 5 μ L or DMSO5 could be used to indicate the syringe method is for dispensing Dimethyl sulfoxide (DMSO) using a 5 μ L syringe.

8.2.1 PRIME TEST

While editing or creating a syringe method the prime function parameters can be validated at any time. The

◀ Prime Test option is active on the bottom line of the display. To test the prime function, place the needle into the liquid to be primed and press ◀ to test the prime parameters. Prime parameters should be adjusted as required.

8.2.2 SAVING A SYRINGE METHOD

When you have finished editing the parameters press ▷ to save the Syringe Method.

8.3 EDITING SYRINGE METHODS

Use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Methods menu and then select the Edit menu. Use the touch wheel to highlight the method that you would like to edit and press ▷ to select. Edit the parameters for the method. Press ◀ to test the prime parameters, once the parameters are correct press ▷ to save the syringe method (Figure 10).

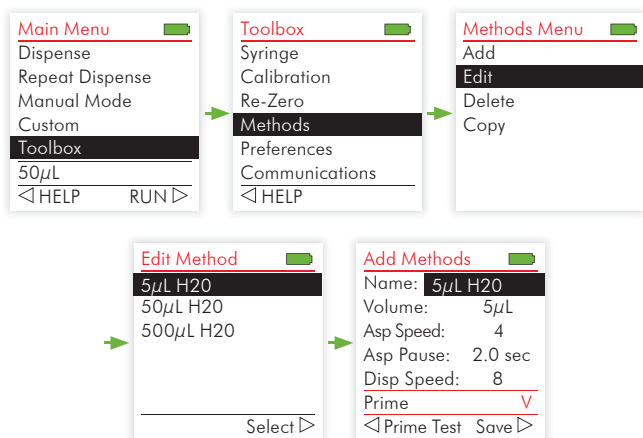


Figure 10. Editing a Syringe Method.

8 SYRINGE METHODS

8.4 DELETING SYRINGE METHODS

Only methods that are not attached to a syringe may be deleted. To delete a syringe method that is attached to a syringe, first change the syringe method attached to that syringe.

Use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Methods option and then select Delete. Use the touch wheel to highlight the method that you would like to delete and press \triangleright to select. You will be prompted to press \triangleleft Yes to delete the method or no \triangleright to return to the previous menu (Figure 11).

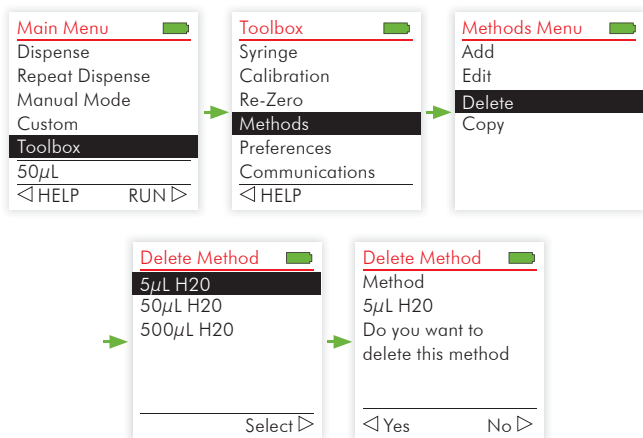
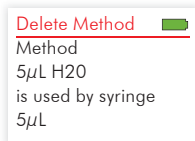


Figure 11. Deleting a syringe method.

Delete Method Associated with a Syringe.

If a method is currently associated with a syringe it cannot be deleted. If you try to delete a method that is associated with a syringe the error message shown in figure 12 will be displayed. Typically you will not want to delete any method that is currently in use, however in order to delete



the method you must first remove all references to the method by all of the syringes. See Section 7.3 Edit Syringe Details.

Figure 12.

8.5 COPYING SYRINGE METHODS

If you have 2 syringes that will be used with similar liquids you can use the same syringe method for both, however you may need to slightly change the method for one of the liquids. In this case it can be useful to copy an existing syringe method to fine-tune it for a specific liquid.

Use the touch wheel to select the Toolbox option from the Main Menu. From the Toolbox menu select the Methods option and then select Copy. Use the touch wheel to highlight the method that you would like to copy and press \triangleright to select. You will be prompted to press \triangleleft Yes to copy the method or no \triangleright to return to the previous menu (Figure 13).

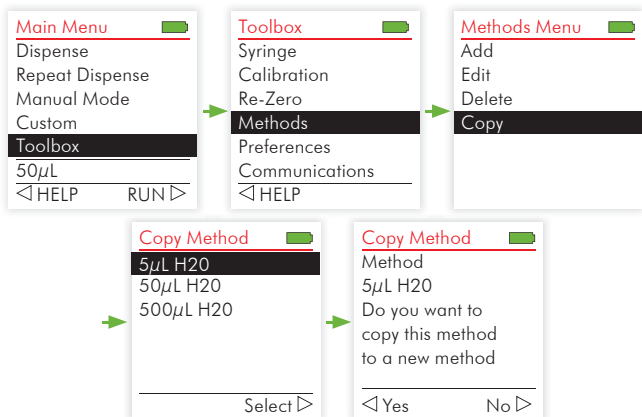


Figure 13. Copying a syringe method

9.1 CALIBRATION OVERVIEW

Your eVol® uses advanced technology to ensure the volume of liquid dispensed is both precise and accurate. Every eVol® is factory tested to ensure its operation complies with a comprehensive list of criteria. To achieve the highest level of accuracy possible each syringe needs to be calibrated. This will ensure when you select a particular volume to dispense your eVol® will deliver that volume more accurately than any other manual syringe-based dispensing technique. A calibration factor for each syringe is used to adjust the software instructions controlling the motor to compensate for any slight variations in the positively-displaced liquid volume.

The calibration procedure for eVol® is based on a gravimetric measure of the volume dispensed from the eVol®. The weight of the liquid dispensed is calculated to a volume dispensed by using the density of the liquid. The calibration factor is calculated by dividing the dispense volume by the calculated volume dispensed. This calculation is automatically performed by the eVol® during the calibration procedure.

The following example shows these calculations:

Calibration Dispense Volume: 20.00 µL

Density of liquid: 1.1

Average Weight Dispensed: 21.512

Calculated Volume Dispensed: $21.512 / 1.1 = 19.5564$

Calibration Factor: $20.00 / 19.5564 = 1.0227$

9.2 CALIBRATION WORKSHEETS

The CD supplied with your eVol® kit contains a Microsoft® Excel based calibration worksheet (Figure 14). This can also be downloaded from **www.sge.com/eVol**.

The worksheet can be used to enter measured weights from dispense data, the worksheet calculates the average dispense in μL . This value should be entered into the calibration screen; the eVol® will use this information to calculate the calibration factor. Once completed the calibration worksheets can be saved or printed as a record of the calibration.

SGE Analytical Science

eVol® Calibration Worksheet

Syringe Unique ID: Calibration Date Today

Calibrated by

Syringe Volume uL

Calibration Dispense volume uL

Liquid Density g/cm³

Vol range

Min vol increment

Figure 14. eVol® Calibration Worksheet

9.3 CALIBRATING A SYRINGE

Equipment required

- A calibrated analytical balance that is capable of accurately and precisely measuring the volume of liquid required for calibrating the syringe. The balance should be capable of measuring the weight of the dispensed volume of liquid to at least two decimal places.

Syringe Capacity	Syringe Volume Range	Recommended Minimum Balance Resolution
500 μL	20 - 500 μL	$\pm 0.001\text{g}$
50 μL	2-50 μL	$\pm 0.0001\text{g}$
5 μL	0.2-5 μL	$\pm 0.00001\text{g}$

The balance should be located in a draft-free environment, where the temperature is between 18-25 °C, constant to ± 0.5 °C with a relative humidity of 50-75%.

- Testing should be done with an appropriate calibration liquid that has been in the test room together with the eVol® and syringe for a minimum of 2 hours. This is to ensure that all test materials have reached equilibrium with the test environment.
- An appropriate weighing container.
- An eVol® calibration worksheet.
(It is recommended you use the eVol® Calibration Worksheet as it can be saved with the calibration data).
- Lint-free tissues.

Syringe Calibration Procedure

1. Install the syringe to be calibrated on the eVol®.
2. Select it through the Change Syringe function (Section 7.5.1).

3. In the eVol® worksheet:
 - 3a. Enter the syringe unique identifier as marked on the syringe you are calibrating.
 - 3b. If you have written an ID tag on the syringe for easy identification this can be entered in the space provided.
 - 3c. Manually type in the date in regional format or press the Today button to enter the date.
 - 3d. Record the name of the person that will calibrate the syringe.
 - 3e. Select the correct syringe capacity from the pull-down list.
 - 3f. Enter the calibration volume that will be used.
 - 3g. Enter the density of the calibration liquid at the temperature of the testing environment.

TIP

Use the largest volume possible for calibrating the syringe, as this will be easier to weigh on a balance and will result in more accurate measurements.

4. Select Dispense mode (Section 10.4.1) for calibrating the syringe.
5. Set the Aspirate Volume and the Aspirate and Dispense Speed.
6. Aspirate the calibration liquid into the syringe.
7. Wipe the outside of the needle tip.
8. Dispense the liquid into the weighing container on the balance.
9. Record the weight of the calibration liquid from the balance and input the weight into worksheet.
10. Repeat steps 6 through 9, ten times.

TIP

For best results make sure no drops of liquid remain on the needle tip when weighing the dispensed liquid.

Entering the Calibration Data into eVol® (Figure 15)

11. Select Toolbox on the Main Menu.
12. Select the Calibration option from the Toolbox menu.
13. Select the Calibration option from the Calibration menu.
14. Highlight Target Volume and press OK.
15. Use the touch wheel to set the desired Target Volume (press ▷ to use the fine setting mode and then the touch wheel to set the value when required) and press OK to save your selection.
16. Move the cursor to the Actual Volume.
17. Use the touch wheel to enter the Average Dispensed Volume from the eVol® calibration worksheet (press ▷ to use the fine setting when required).
18. Press OK to save your selection.
19. Press ◀ to calculate the new calibration factor for the syringe.
20. The New and Current Factors are displayed.
21. Press ▷ to Save the new calibration factor with the syringe details.
22. You are returned to the Calibration menu.
23. To check and re-validate, repeat Steps 1-5 in Section 9.3 Syringe Calibration Procedure.

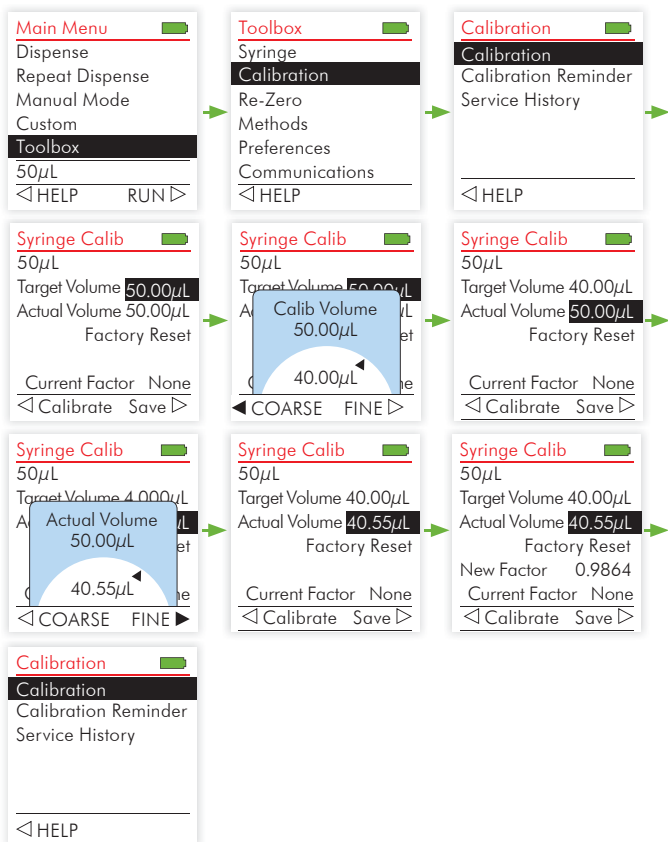


Figure 15. Entering the Calibrating Data

9.4 RESETTING THE CALIBRATION CORRECTION FACTOR

After calibrating, it is possible to view the new Calibration Factor for a syringe in the Toolbox menu. It is also possible to reset the Calibration Factor back to the original setting. Follow these simple steps to reset the Calibration Factor back to the original setting (Figure 16).

⚠ CAUTION

After doing so, it is recommended that the eVol® accuracy be validated again using the syringe calibration procedure (Section 9.3 Syringe Calibration Procedure).

1. Select Toolbox from the Main Menu.
2. Select the Calibration option from the Toolbox menu.
3. Select the Calibration option from the Calibration menu.
4. Highlight the Factory Reset option and press OK.
5. Press ◀ to Calibrate and apply the factory setting.
The New and Current Factors are displayed.
6. Press ▶ to save the new calibration factor with the syringe details. Now you are returned to the Calibration menu.

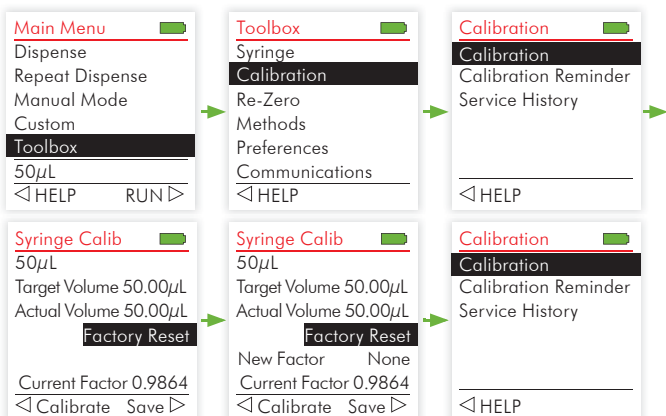
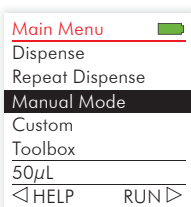


Figure 16. Resetting the Calibrating Data

10.1 INTRODUCTION TO PROGRAMMING

There are two ways to program eVol®:

- 1 Function-based Programming Modes** - You can select from 3 predefined programming modes that you can quickly and easily edit and execute.
- 2 Custom Step-based Programming Modes** - You can create and store in memory up to 10 multi-stepped protocols using a set of command functions.



Options common to all modes are presented in Section 10.2, below. Function based programming modes are described in Section 10.4. Custom programming mode is described in Section 10.5. All programming modes and options are accessed from the Main Menu.

10.2 EDITABLE PROGRAM VARIABLES

Each program mode is designed to perform a simple, predefined dispensing task or group of tasks where volume and speed are controlled variables (Table 4).

Modes	Options								
	Speed	Help	Edit	Pace	Volumes			Direction	Count
					Aspirate	Dispense	Last Disp.		
Dispense									
Repeat Dispense									
Manual Dispense									

Table 4. Function Based Program Modes and Variables.

Mode options are described in the following subsections.

Note that the Direction option is used only in Manual Dispense mode and is described in Section 10.4.3.

10.3 QUICK ACCESS MENU

The quick access menu provides a quick means of accessing some important functions or other menus.

10.3.1 SPEED SELECTION

The Speed option controls the speed at which liquid is aspirated or dispensed in each mode. Speed can be set as a value from 1 (slowest) to 10 (fastest).

When in Run mode, use the touch wheel to highlight the Speed option for the current operation. For example selecting Speed when the Aspirate function is highlighted with a dot will allow the aspirate speed to be changed. Press OK and a Speed setting “dial” is displayed (Figure 17).

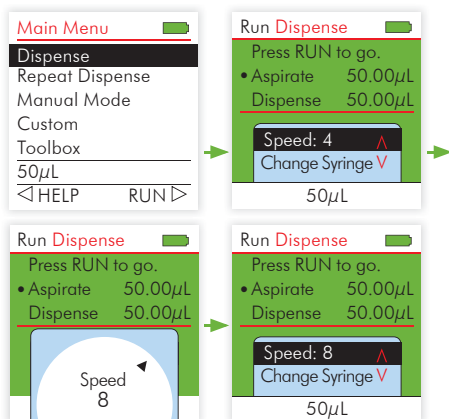


Figure 17. Speed Example

Speed also may be changed in most Edit menus. In Edit, scroll to the Speed to be changed and press OK. Use the touch wheel to choose the speed, press OK, and press to save your selections (Figure 18).

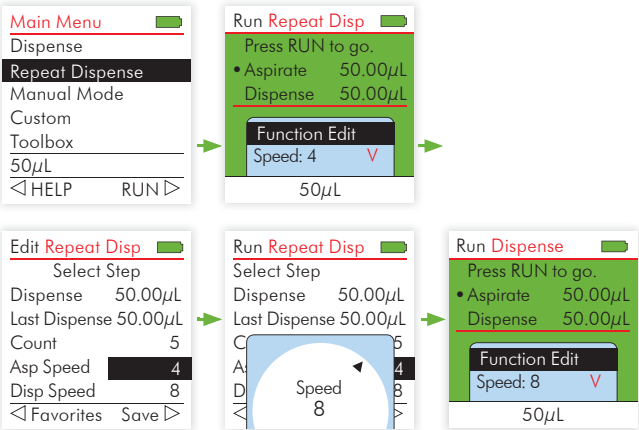


Figure 18. Speed Options on Edit Menus

The Speeds selected in the Dispense, Repeat Dispense and manual modes are stored uniquely for only the current instance of that function. They are not stored back into the syringe method. If the speed settings need to be altered and used with various dispensing modes they should be changed in the syringe method.

TIP

Viscous samples should be aspirated and dispensed at slower speeds to increase accuracy in aspiration and dispensing.

10.3.2 FUNCTION EDIT

The Function Edit option is available for all dispensing modes. It enables you to access the variables that you can adjust.

10 PROGRAMMING

Select the Repeat Dispense mode. Then, select Function Edit from the list in the Quick Access Menu. A list of options for the active mode is displayed. For example, the variables associated with Repeat Dispense are displayed (Dispense, Last Dispense, Count, Asp Speed and Disp Speed) (Figure 19).

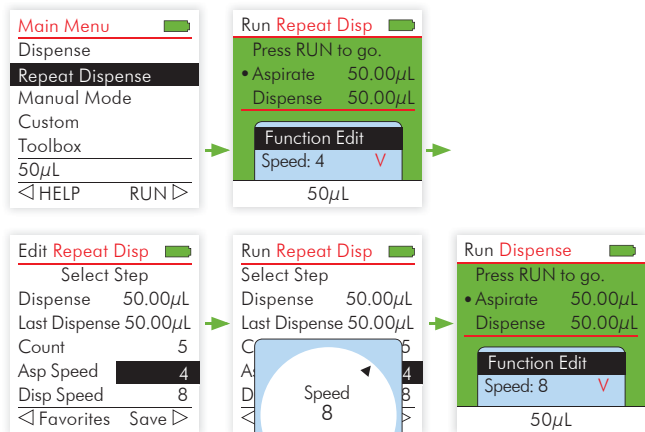


Figure 19. Edit Options.

A review of each variable is provided in the following mode descriptions.

10.3.3 PACE SELECTION

The Pace option sets the time duration between dispenses for repeat dispensing in Repeat Dispense mode. While you press and hold the RUN button, the eVol® will dispense the programmed volumes with the selected pace between each dispense. Release the RUN button to stop the paced dispensing. Press the RUN button to continue dispensing.

If in Repeat Dispense mode select Pace from the list in the Quick Access Menu.

Pace can be selected in intervals from 'None - 9'. Use the touch wheel to select the desired Pace option. Press OK and a Pace setting “dial” is displayed. Selecting a pace setting of 'None' turns the pace function off. This is the default setting. Use the touch wheel to select the pace, from 'None - 9'. Press OK to save your setting (Figure 20).

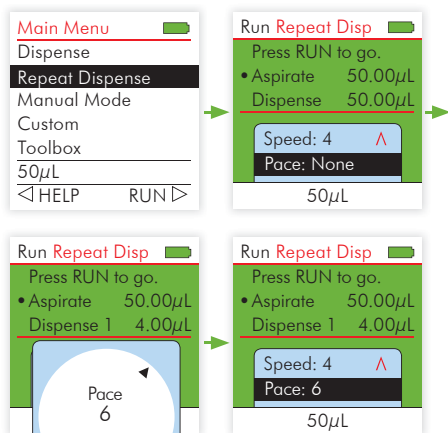


Figure 20. Pace Example.

10.3.4 VOLUME SELECTION

You can change any volume available in Dispense, Repeat Dispense and Manual modes in two ways by:

- Using the Function Edit option and touch wheel to change a volume at any time while using a mode.
- Or, select from a list of saved “favorite” volumes which are accessed through the quick access menu under Favorites. These favorite volumes can be edited at any time.

Change a Volume Using the Function Edit Option and Touch Wheel

To change a volume at any time select Function Edit from the Quick Access Menu (as described in Section 10.3.2). When in Dispense or Manual mode the Volume setting dial is displayed and the volume can easily be changed. When in Repeat Dispense or a Custom Program by selecting Function Edit a list of editable parameters is displayed, use the touch wheel to set the volume you want to change (for repeat mode either Dispense or Last Dispense). Press OK and a Volume setting “dial” is displayed. Use the touch wheel to change the volume. Press OK to confirm your volume selection. Press \triangleright to save (Figure 21).

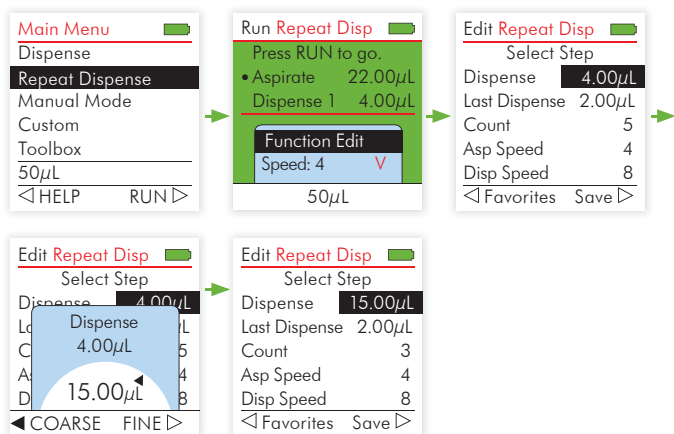


Figure 21. Select and Edit a Volume

TIP

Use the navigation buttons to change the volume in coarse or fine increments. Select COARSE (with \triangleleft) to change the volume in larger increments. Select FINE (with \triangleright) to change the volume in smaller increments. The increment sizes vary based on the syringe capacity selected as shown in Table 5.

Syringe Capacity (μL)	500	50	5
Maximum Program Volume (μL)	500	50	5
Minimum Program Volume (μL)	20	2	0.2
Scrolling Volume Fine (μL)	0.5	0.05	0.005
Scrolling Volume Coarse (μL)	10	1	0.1
Display Decimal Points	1	2	3

Table 5. Program Volumes and Coarse/Fine Increments

Select 1 of 10 Saved Favorite Volumes to Use

Select the Function Edit option (as described in Section 10.3.2) and press the OK button, the volume(s) that can be edited for that selected mode will be displayed. Use the touch wheel to highlight the volume you want to edit. Then press ◀ for the Favorites option to display a list of the last 10 volumes saved for the currently installed syringe size. Use the touch wheel to highlight the volume you want to use and press the OK button. Press ▶ to save (Figure 22).

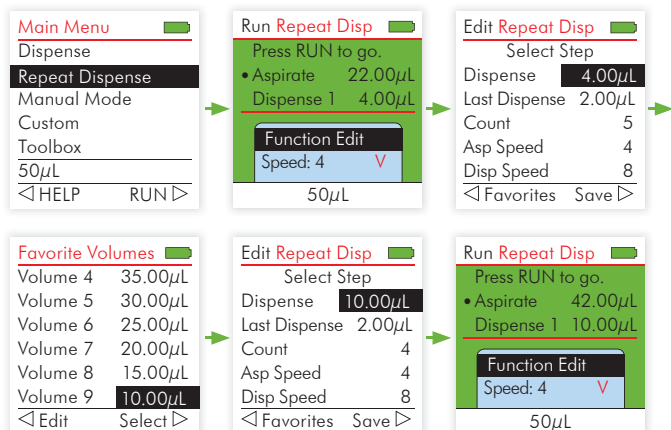



Figure 22. Using Favorite Volumes.

10.3.5 COUNT SELECTION

The Count option is used in the Repeat Dispense mode. The Count mode is accessed with the Function Edit option (described in Section 10.3.2). Use the touch wheel to highlight the Count option. Press OK and a setting “dial” is displayed. Use the touch wheel to select the Count value. Press OK and then press  to Save your setting(s) (Figure 23).

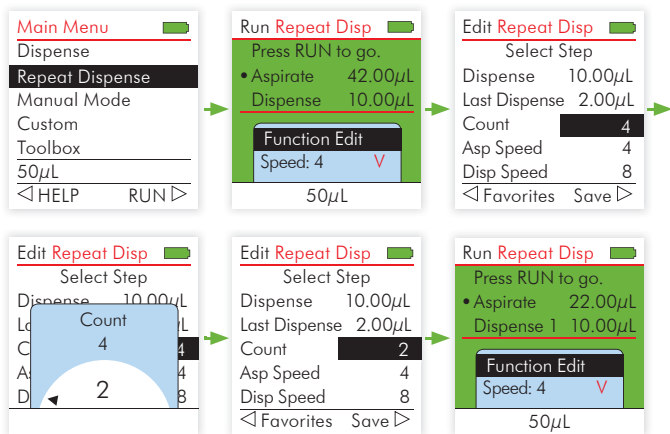


Figure 23. Count Example

10.4 PREDEFINED PROGRAMMING MODES

eVol® contain 3 predefined programming modes that you can quickly and easily edit and execute; Dispense Mode, Repeat Dispense Mode and Manual Mode.

10.4.1 DISPENSE MODE

Dispense mode is used for simple liquid transfers where aspirate and dispense volumes are equal.

Application: Use this mode for quick transfer of liquid between tubes, vials, micro-well plates and other liquid storage devices.

Operation: With the syringe needle in liquid, press and release the RUN button to aspirate. (see note).

With the syringe needle in the destination container, press and release the RUN button to execute the dispense.

TIP

Whenever the syringe plunger direction changes from aspirate to dispense, the eVol® will always over-aspirate, it then returns to the correct position after the syringe method aspirate pause time has expired. This action removes any mechanical error; it also re-compresses any tiny cavitation bubbles that may have formed during the aspirate stroke. The over-aspirate volume is approx 4% of the total syringe capacity.

10.4.2 REPEAT DISPENSE MODE

The Repeat Dispense mode is used for repetitive dispensing of a programmed volume of liquid.

Select the dispense volume and the maximum number of possible dispenses (Count) is calculated automatically for the installed syringe capacity. The count may be changed to a smaller value if desired. If the Last Dispense Volume plus the sum of the Dispense volumes exceeds the syringe capacity an error is generated and **ERROR ▷** is displayed in the bottom line. Press ▷ to view the error.

Application: This mode can be used for fast reagent addition to multiple vessels or wells from one source container. A large volume can be aspirated then dispensed in multiple aliquots to multiple targets.

The sequence returns to the aspirate step after the Last Dispense (waste) volume is dispensed.

Operation: **Single Step Dispensing:**

With the needle tip in liquid, press and release the Run button to initiate the aspirate step. Press and release the RUN button to dispense each reagent aliquot.

Paced (Automatic) Dispensing:

If the Pace setting is not set to "none", pressing and holding the RUN button will dispense aliquots of liquid with the selected pause between dispenses. This operation will automatically stop once all the aliquots have been dispensed and only the waste volume remains.

In both modes the display will show "Running Step" and the aliquot step number. A beep will be heard after the final dispense, the Last Dispense (waste) volume remains. You can choose to use this Last Dispense or discard it. Press and release the RUN button to dispense the Last Dispense volume.

Place the needle tip into the aspirate reagent. Press and release the RUN button to automatically aspirate reagent.

TIP

Remove the needle tip from the liquid at the end of a paced dispense to prevent aspiration of liquid.

10.4.3 MANUAL MODE

The Manual Mode is used when more operator control is required for aspirating and dispensing unknown volumes. Use this mode to measure an unknown amount of liquid. Toggle between Aspirate and Dispense using the Direction option in the Quick Access menu.

Application: This mode is ideal when aspiration volume is not clearly defined or well known. In Manual mode, you have control over the aspiration and dispense steps and can view the display to confirm how much liquid has been aspirated or dispensed. Manual control over the dispense steps is perfect for performing titrations.

Operation: When aspirating, the motor will stop when you release the RUN button or when the programmed aspirate volume is reached.

You can change from aspirate to dispense mode at any time even if aspiration volume is not reached.

10 PROGRAMMING

Titration can be performed by dispensing in this mode. The volume remaining in the syringe is always actively displayed.

TIP

Use slower speeds (1-5) for better control and resolution.

Direction: Change the direction of the syringe plunger movement by selecting the Direction option in the Quick Access Menu and pressing OK. The notation on the display changes between Λ (Aspirate) and V (Dispense) (Figure 24).

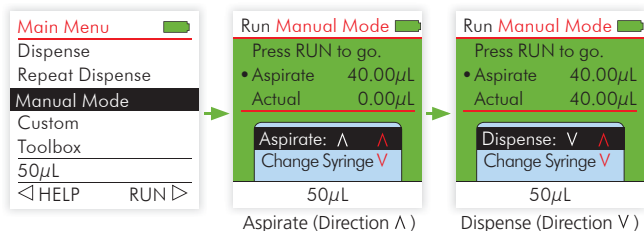


Figure 24. Manual Mode Syringe Plunger Direction

10.5 CUSTOM STEP-BASED PROGRAMMING MODE

Custom step-based programming mode allows for the creation and storage of multi-stepped dispensing protocols using the seven basic operations shown in Table 6.

You can create and store up to 10 custom programs containing 98 steps in eVol® memory.

Custom programs are volume specific so when creating a custom program you are first prompted to enter the

applicable syringe volume. The custom program can be edited at any time by selecting Function Edit from the Quick Access menu.

Operation	Operation Parameters
Syringe	<p>This Operation cannot be selected and is automatically inserted at line 1 of each custom program. It cannot be deleted or moved.</p> <p>Custom programs use absolute volumes and must be assigned to a compatible syringe capacity. This is achieved by selecting a syringe selected from list of available syringes.</p>
Aspirate	<p>Volume: Volume range will depend on the syringe selected in line one of the custom program (see Section 7 for syringe ranges).</p> <p>Speed: 1 to 10</p>
Dispense	<p>Volume: Volume range will depend on the syringe selected in line one of the custom program (see Section 7 for syringe ranges).</p> <p>Speed: 1 to 10</p>
Pause	<p>Prompt: A user defined prompt of up to 3 lines 28 characters per line.</p> <p>Seconds: 0 – 360</p> <p>Continue: Auto (A) – Operation continues once pause time has elapsed. Manual (M) - Device beeps once pause time has elapsed. Operation is paused until the RUN button is pressed.</p>
Prime	Executes the prime sequence as per the currently installed syringe method.
Prompt	<p>Prompt: A user defined prompt of up to 3 lines 28 characters per line. Operation is paused until the RUN button is pressed.</p>
Mix	<p>Mix Volume: Volume range will depend on the syringe selected in line one of the custom program (see Section 7 for syringe ranges).</p> <p>Mix Cycles: 1 to 30</p> <p>Mix Asp Speed: 1 to 10</p> <p>Mix Disp Speed: 1 to 10</p>
Purge	Speed: 1 to 10

Table 6. Custom Program Operations and Parameters.

10.5.1 CREATE A NEW CUSTOM PROGRAM

To create and save a new custom program, use the touch wheel to select the Custom option from the Main Menu. A list of saved custom programs will be displayed. Press ▷ to select New.

As custom programs are created using absolute volumes, a compatible syringe capacity must be assigned to each custom program. A compatible syringe must be selected from the displayed list of available syringes before operations can be added. Use the touch wheel to highlight the syringe and press ▷ to select it.

The selected syringe is automatically inserted at line 1 and cannot be deleted or moved. The custom program is initially assigned a name automatically (e.g. Custom 1). After it is saved the custom program name can be changed through the Name option (described in Section 10.5.3). A list of operations is also displayed. A list of operations and required parameters is shown in Table 6.

Use the touch wheel to select the first step in your Custom program. Then, press OK. Each operation requires a set of parameters to be entered. These are automatically displayed when the operation is selected. Use the touch wheel to select the parameter value and press OK.

Figure 25 shows an example of adding an Aspirate operation. In this example set the volume value and press OK. Set the speed for that step and press OK. The line entered into the custom program reflects the line number, the operation and the parameters. An aspiration of 3.00 μL with speed setting 8 is programmed.

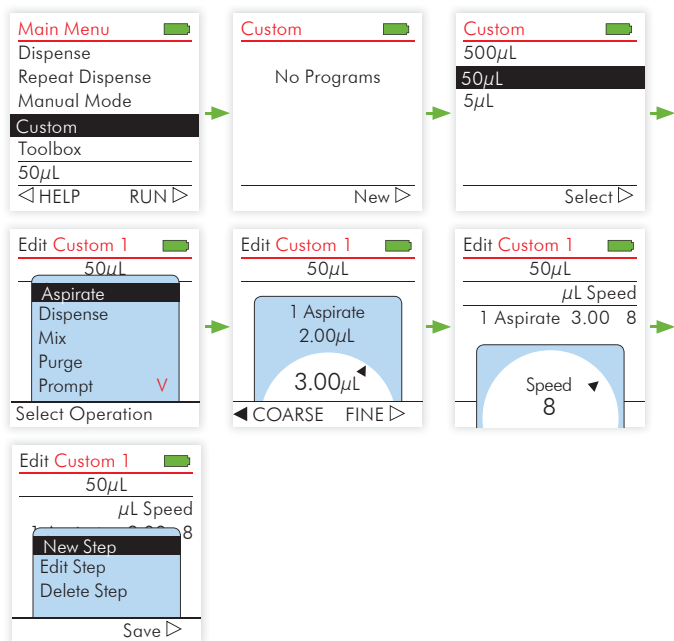


Figure 25. Creating a Custom Program.

Next, you have the options of adding a new step, editing a step, or deleting a step. Descriptions of each option are provided in Table 7.

Option	Description
New Step	Press OK to add a new step. Use the touch wheel to select the step position. Then, press OK. Use the touch wheel again to select the step operation from the list. Set the variable parameters for that operation, as appropriate. Complete the step by pressing OK.
Edit Step	Use the touch wheel to select the step to edit. Press OK. Use the touch wheel again to select a different step operation from the list. Set the variable parameters for that operation, as appropriate. Complete the step by pressing OK.
Delete Step	Use the touch wheel to select the step to delete. Press OK.

Table 7. Custom Programming options.

10.5.2 SAVING A CUSTOM PROGRAM

While editing or creating a custom program, press the Save ▸ button, to save the custom program with the name displayed on the top line.

10.5.3 VIEW/EDIT, DELETE, COPY OR NAME A CUSTOM PROGRAM

At the custom program display, use the touch wheel to highlight an existing custom program. Press ◀ Options button to select it (Figure 26).

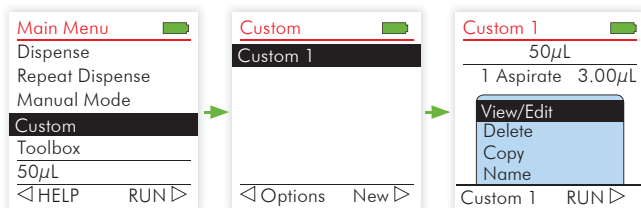


Figure 26. Displaying Custom Program Options

Next, you have the options of View/Edit, Delete, Copy or Name a custom program. Descriptions of each option are provided in Table 8.

Option	Description
View/Edit	Use this option to review a program. With the View/Edit option highlighted, press the OK button. If you then want to alter the program, press ▸ to Edit. Or, to change a specific step in the program, use the touch wheel to select the step and then press OK. As described in Section 10.5.1, you have the options of adding a new step, editing a step, or deleting a step. After editing is completed, press ▸ to Save.

Delete	This option allows you to delete the program (not just a step within the program). With the Delete option highlighted, press the OK button. The display will prompt: Do you want to Delete this Program? Press ◀ (Yes) to delete the program. Or, press ▶ to continue without deleting.
Copy	You may find that it is easiest to copy an existing program in order to create another. With the Copy option highlighted, press the OK button. The program is copied automatically. Press OK to continue. Now, you can press ◀ for Options to customize the copied program.
Name	Use the touch wheel to select a letter and press the OK button to confirm the letter selection. Press ◀ Delete to delete the last letter in the name. To save the new Custom Program name press Save ▶. Press ↶ to exit without saving changes to the Custom Program name.

Press ↶ to return to the list of Custom programs.

Table 8. Options of View/Edit, Delete, Copy or Name a custom program.

10.5.4 RUNNING A CUSTOM PROGRAM

There are several ways to run a Custom program.

Run a Custom Program (Figure 26)

1. From the Main Menu, select Custom.
2. Highlight the Custom Program from the list (such as Custom 1, Custom 2, etc.).
3. Press the OK button.
4. Press and release the Run button to initiate the first program step.

Run a Custom Program After Changing Variables (Figure 27)

1. From the Main Menu, select Custom.
2. Highlight the Custom Program from the list (such as Custom 1, Custom 2, etc.).

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3. Press the OK button.
4. Highlight Function Edit in the Quick Access menu and review and edit the custom program by pressing OK and then Edit \triangleright , as desired (described in Section 10.5.1).
5. Press the Save \triangleright button to return to the Custom Program menu.
6. Press and release the RUN button to initiate the first program step.

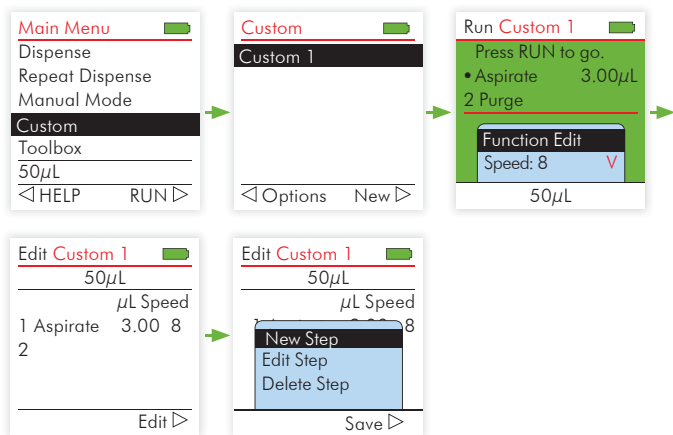


Figure 27. Run a custom program after changing variables.

Run a Custom Program After Changing the Program (Figure 28)

1. From the Main Menu, select Custom.
2. Highlight the Custom Program from the list (such as Custom 1, Custom 2, etc.).
3. Press \triangleleft Options.
4. Review and edit the custom program by pressing OK and then Edit \triangleright , as desired (described in Section 10.3.2).
5. Press the Save \triangleright button to return to the Custom Program menu.

6. Press the OK button to return to the run menu.
7. Press and release the Run button to initiate the first program step.

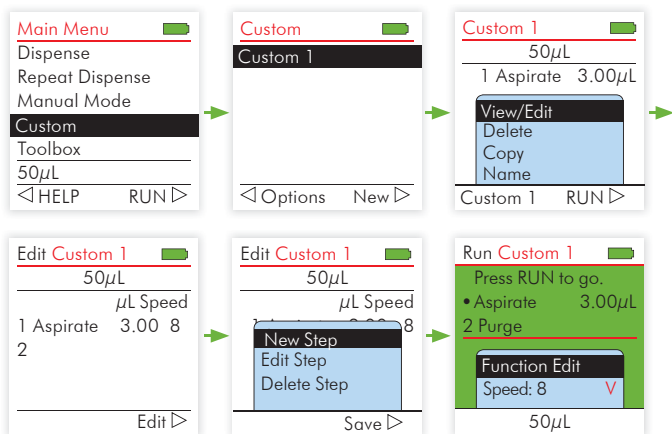


Figure 28. Run a custom program after changing the program.

10.5.5 CUSTOM PROGRAM RULES

- After you create and enter a program, if any volume remains in the syringe after the program is run the message: "Purge" will appear on the display: Press and release the RUN button and all liquid will be purged from the syringe. The display will return to step 1 in the custom program.
- If you create a program that contains only one Aspirate step (i.e. Aspirate 100 µL), a Purge operation is automatically inserted as the last line. When the aspiration step is complete the message: "Purge" will appear on the display: Press and release the RUN button to purge all aspirated liquid from the syringe. The display will return to step 1 in the custom program.

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TIP

You could also create this same program by:

1 Aspirate 100

2 Dispense 100

Or

1 Aspirate 100

2 Purge

- If a program contains multiple aspirate steps with no dispense, “Purge” will appear in the display after the last aspirate step has completed. Press the RUN button to purge all liquid from the syringe.

TIP

You could also program this by:


1 Aspirate 200

2 Aspirate 50

3 Aspirate 100

4 Purge

- A combination of Aspirate and Dispense steps are possible. The same rules apply. Whenever the eVol® is instructed to go from an aspirate stroke to a dispense stroke an over-aspirate is conducted, it then returns to the correct position after the syringe method aspirate pause time has expired. This action removes any mechanical error; it also re-compresses any tiny cavitation bubbles that may have formed during the aspirate stroke. The over-aspirate volume is approx. 4% of the total syringe capacity.
- If there is a programming error where either the total cumulative aspirate volume exceeds the syringe capacity, or the total cumulative dispense volume is less than zero, an error message is displayed. To view the error press the Error▷ button. The line number and a description of the error are reported. The error must

be fixed before the program can be saved. Pressing the  Back button will exit without saving (Figure 29). See Troubleshooting Section 11 for more information.

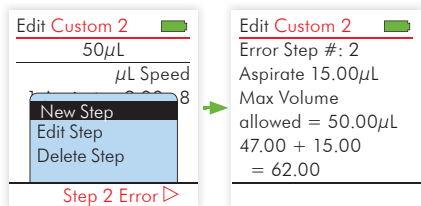


Figure 29. Programming error.

10.6 TOOLBOX

As well as Syringe, Calibration, Re-Zero and syringe Methods options the Toolbox menu provides options for calibration reminders, storing owner information, and setting other personal preferences.

10.6.1 PREFERENCES

Five Preference options exist, enabling you to customize Sound, the Display, the Main Menu, the Touch Wheel, and the Purge Key Speed (Figure 30).

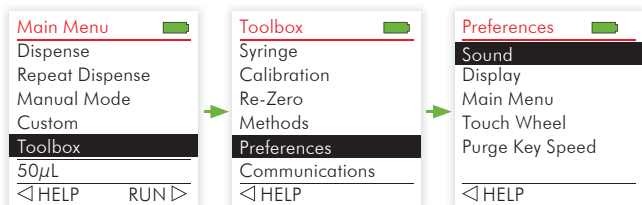


Figure 30. Preference options.

Sound

This is the beep tone selection. You can select the beep tone on/off.

When this Option is On	A Beep Tone will Sound:
Step Complete	At the end of a function or program step.
Program Complete	At the end of program completion.
Purge Key	When Purge/Prime is pressed.
Error Message	When a programming error message appears or when illegal data entry is attempted.
Touch Wheel	When scrolling with the touch wheel.
Last Dispense	Before the last dispense in Repeat Dispense mode.

With an option highlighted, press OK to change the status between On and Off. After changing desired settings, press ▷ to save.

Display

The Display option enables you to customize your display. You can select:

Option	Usage
Start up Display	<p>Press OK to select this option. Then, scroll to select the startup display as one of the following:</p> <ul style="list-style-type: none"> Safety Warning • None Custom 1 Custom 2 <p>A dot to the right of the option indicates the selected start up display. Press ▷ to save your selection.</p>
Display Dimming Time	<p>The display will dim after a set number of minutes. Press OK to select this option. Then, use the touch wheel to display the desired value (between 1 and 20 minutes or Never). Press OK again to save your selection.</p>

Turn Off Time	By default, the eVol® will turn off after 5 minutes of idle time. However, you can change this setting. Press OK to select this option. Then, use the touch wheel to display the desired value (between 5 minutes and 1 hour). Press OK again to save.
---------------	--

Main Menu

With this option, you can turn on/off the display of the functions on the Main Menu. In this example (Figure 31), the Repeat Dispense mode is turned off:

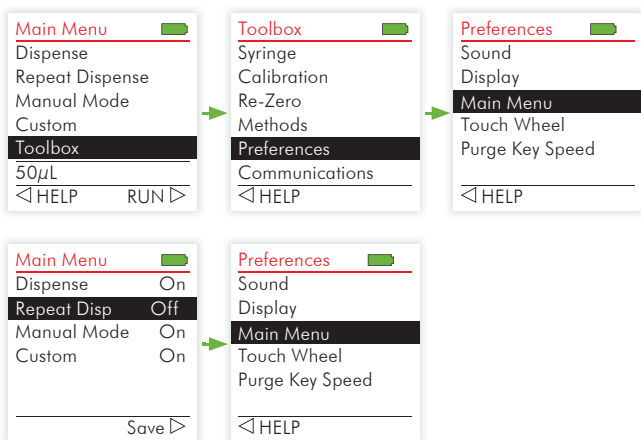


Figure 31. Example of Main Menu Display Options.

With an option highlighted, press OK to toggle between On and Off. After you change all desired settings, press > to save.

Touch Wheel

This option can be used to adjust the touch wheel spin sensitivity. Highlight the desired option of Low, Medium, or High. With an option highlighted (indicated with a dot to the right of the option), press > to save (Figure 32).

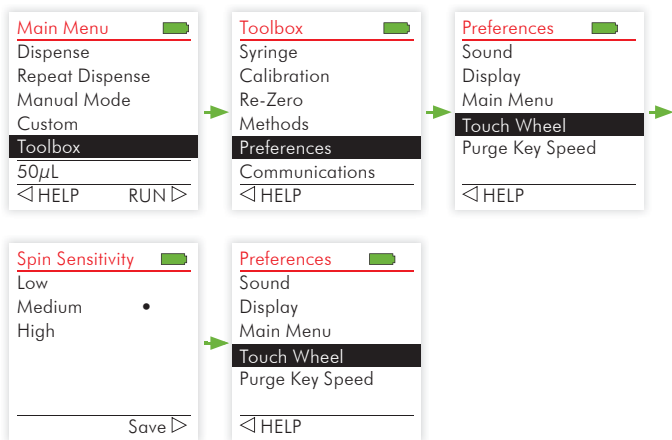


Figure 32. Spin Sensitivity Options.

Purge Key Speed

With this option, the speed of the purge can be adjusted. Scroll to Purge Key Speed, press OK, choose the desired speed, and press OK to save the value (Figure 33).

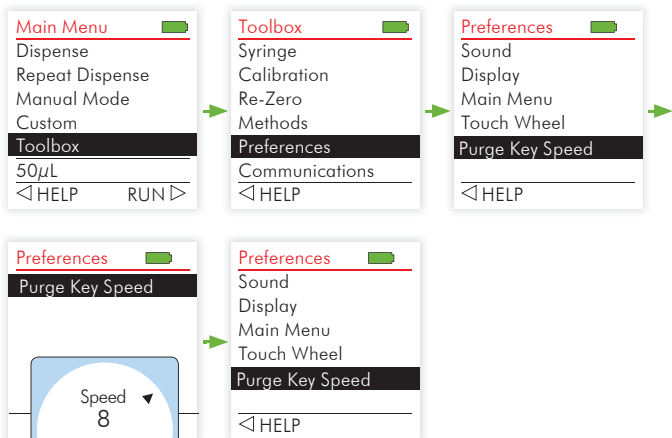


Figure 33. Purge Key Speed options.

10.6.2 CALIBRATION REMINDER

The Calibration Reminder can be set under the Toolbox/Calibration/Calibration Reminder/Time menu item (Figure 34).

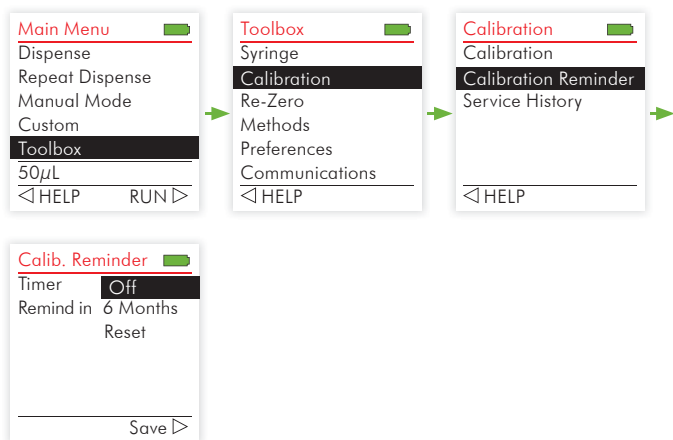


Figure 34. Accessing the Calibration Reminder Timer.

Option	Usage
Timer	You can turn the reminder timer On or Off. With this option highlighted, press OK to toggle between On and Off.
Remind in	This option lets you set a reminder interval for calibration. It is recommended that all syringes be calibrated at the same time. Use the touch wheel to select this option, press OK and the reminder setting “dial” is displayed. Use the touch wheel to select the reminder interval, from 1 to 12 months. Press OK to save your setting. When the reminder ‘pops up’ on the display, you can press any key to ignore it. However, the reminder will re-displayed every time the eVol® is turned on until you change the reminder time or use the Reset option (as described below).

Reset	You can reset the eVol® calibration reminder timer. Use the touch wheel to select this option and press OK. A message, 'Reset Complete' indicates the reset selection was successful.
-------	---

After you change all desired settings, press \triangleright to Save.

Service History

Select the Service History option to see notes from SGE Analytical Science for any service that took place on the device.

10.6.3 OWNER INFORMATION

You can set a personal ID in the Owner Information option. In addition, you can view information about your eVol®. For example (Figure 35):

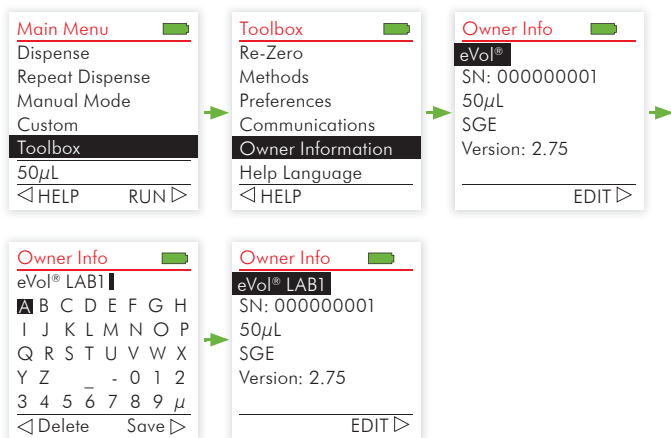


Figure 35. Owner Information option.

Option	Usage
eVol®	You can enter information, such as a name, for your eVol®. To do so, press \triangleright to EDIT. The display shows the alphabet and numbers as well as the underline () and dash (-) characters. Use the touch wheel to scroll to highlight a character that you want to enter. Then, press OK. Each highlighted character appears on the display as you press OK. You can press \triangleleft to Delete the last character entered. You can continue to press \triangleleft to delete each subsequent character. After you enter the desired text, press \triangleright to Save.
S/N, etc.	The eVol® serial number (S/N) and version number are displayed automatically.

10.6.4 HELP LANGUAGE

You can choose the language in which all help screens are displayed. Scroll to the desired language and press to save this preference. For example (Figure 36):

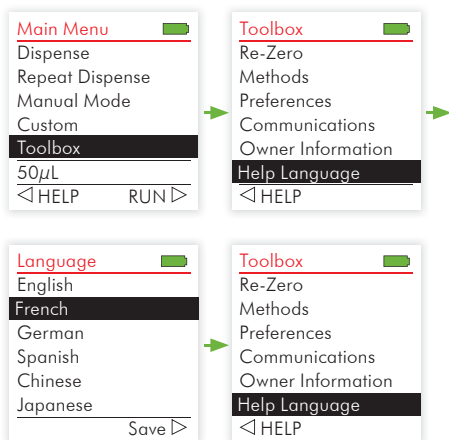
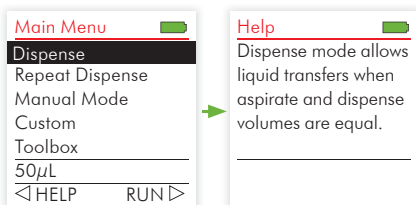


Figure 36. Help Language option.

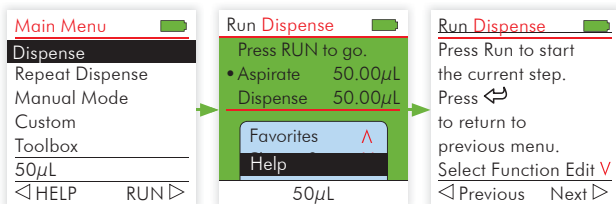
10.6.5 HELP

The Help information available for each mode describes the mode operation. You can select Help in two ways:

1 With the desired mode highlighted on the Main Menu, press \triangleleft to select the HELP option. Press $\triangleleft \rightarrow$ to return.



2 Or, select the Help option in the Quick Access menu. Then, select Edit on the list of options. For example, if you select Help on the Dispense screen, a brief description is displayed (below).



Refer to Section 16, eVol® Help Information, for a complete listing of Help information as it appears on the eVol® display.

Language-specific help files for the eVol® are available from the Toolbox menu option (Refer to Section 10.6.4).

11 TROUBLESHOOTING

11.1 GENERAL TROUBLESHOOTING

Problem	Probable Cause	Solution
Dispense results are inaccurate.	<ul style="list-style-type: none">• Syringe incorrectly attached.• Syringe not correctly calibrated.	<ul style="list-style-type: none">• Refit syringe.• Follow re-calibration instructions.
Inaccurate dispensing with certain liquids.	<ul style="list-style-type: none">• Unsuitable calibration.• Incorrect aspirate and dispense speed.	<ul style="list-style-type: none">• Re-calibrate with the liquids in question.• Adjust aspiration and dispense speed depending on liquid:<ul style="list-style-type: none">- High viscosity liquids will require slower speeds.
Plunger de-couples from plunger drive.	<ul style="list-style-type: none">• Certain liquids can effect the plunger tip material and increase the force required to drive the plunger.• The syringe plunger tip can sometimes stick to the glass if left for long periods without use.	<ul style="list-style-type: none">• Manually flush the syringe with water.• Manually cycle the syringe plunger.
No dispensing/aspirating.	<ul style="list-style-type: none">• Plunger is jammed or damaged.• Plunger is not connected correctly.• Motor not running	<ul style="list-style-type: none">• Remove the syringe, inspect the plunger function manually and if undamaged replace the syringe and re-test.• If damaged replace the plunger.• Check battery charge level.

Table 9. eVol® General Troubleshooting.

11.2 ELECTRICAL TROUBLESHOOTING

Problem	Probable Cause	Solution
When pressing RUN, a 'Battery Low' message appears on the Run screen.	<ul style="list-style-type: none">• Low battery.	<ul style="list-style-type: none">• Re-charge the battery in order to resume operation.• Plug the power cord into the eVol®. <p><i>Note: It takes 15-30 seconds to store enough voltage to operate the eVol®.</i></p>

11 TROUBLESHOOTING

Problem	Probable Cause	Solution
Display turns off completely.	<ul style="list-style-type: none"> Dead battery. 	<ul style="list-style-type: none"> Charge the batteries with a power cord or charge stand.
Touch wheel response is erratic and uncontrollable.	<ul style="list-style-type: none"> A finger was on the touch wheel when the eVol® was turned on. Sensitivity setting is not set correctly. 	<ul style="list-style-type: none"> Reset the eVol® without touching the touch wheel during reset. Adjust the touch wheel sensitivity with Toolbox, Preferences, Touch Wheel (see Section 10.6.1).
Displayed characters are scrambled.		<ul style="list-style-type: none"> Reset the eVol®.
<p>Battery charging indicator is not pulsing while on the stand.</p> <p>Unit does not turn on when placed on the charging stand.</p>	<ul style="list-style-type: none"> Charge stand pins are out of place. 	<ul style="list-style-type: none"> Check that both charge stand conductor pins are at the same height. Make sure the charger is plugged in.
Error message is displayed: 'Home Found' or 'Home Not Found'.	<ul style="list-style-type: none"> Indicates too much friction was encountered during operation. Indicates possible motor failure. 	<ul style="list-style-type: none"> Reset the eVol®. Remove the syringe, inspect the plunger function manually and if undamaged replace the syringe and re-test. If problem persists, please contact SGE for technical assistance.
Motor sounds rough and aspiration is very slow.	<ul style="list-style-type: none"> eVol® has been set to the slowest speed. 	<ul style="list-style-type: none"> Verify the speed setting. The slowest speed setting normally causes the motor to run slowly and louder than normal.

Table 10. eVol® Electrical Troubleshooting.

11.3 VOLUME ERROR MESSAGES

You may see a volume error message as the one shown in Table 11. The message is displayed when a volume entered exceeds the syringe capacity. The volume will vary based on the capacity of the syringe.

If a program is created for a particular volume that is incompatible with the syringe being used an error message will be displayed.

For example, consider the Repeat Dispense mode when using a 500 μL syringe. If you enter a dispense volume of 100 μL and a count value of 6 the total volume is 600 μL , which is 100 μL greater than the maximum volume allowed. You would see this error message:

Dispense Vol* Count
+ Last Dispense
exceeds
Max Volume =
500 μL

In the error message below:
n Indicates the maximum allowable volume for the installed syringe.

Mode	Display Text
Repeat Dispense	Dispense Vol* Count + Last Dispense exceeds Max Volume allowed = <u>n</u>

Table 11. Volume Error Messages.

If this error message occurs adjust the parameters or change to a syringe with a suitable capacity and continue.

11.4 CUSTOM PROGRAM STEP ERROR MESSAGES

You may see an error message as shown in Table 12. The message is displayed when a volume entered exceeds syringe capacity. The volume will vary based on the capacity of the syringe.

For example, when using a 500 μL syringe, if you enter two aspiration steps with the volumes 250 μL and 300 μL , the total volume is 550 μL , which is 50 μL greater than the maximum volume allowed. An error message would indicate an error at Step 2:

Error Step #: 2
Aspirate 250 μL
Max Volume allowed
= 500 μL
250 + 300 = 550 μL

In each message below:

- s Indicates the step number in which the error occurred.
- x Indicates the calculated volume based on the information you entered.
- y Indicates the amount of volume that is left in the installed syringe.
- n Indicates the maximum allowable volume for installed syringe.

In each case, the corrective action is to adjust the volume amount entered.

Program Step	Display Text
Aspiration Error	Error Step #: <u>s</u> , Aspirate <u>x</u> , Max Volume allowed = <u>n</u>
Dispense Error	Error Step #: <u>s</u> , Dispense <u>x</u> , Current <u>y</u> , Max Dispense <u>n</u>

Table 12. Custom Program Error Messages.

12.1 CLEANING

eVol® automated analytical syringes require very little routine maintenance.

Syringe Cleaning

- Syringe cleaning agents will usually depend on the contaminating material, but acetone is commonly used.
- Do not immerse the entire syringe in any solvent as this may damage the adhesive used to bond parts of the syringe. Clean externally by wiping with a tissue.

PTFE plunger tip care

- Minimize cycling the plunger when dry if possible.
- Replacement plungers are available for eVol® syringes.

eVol® Drive Unit

Under certain conditions, it may be necessary to clean the external components on your eVol®. It is recommended that cleaning be performed with a lint-free cloth lightly moistened with mild soap solution in distilled water or methyl alcohol. The materials used on the exterior of the eVol® support regular cleaning intervals.

If liquid ever enters your eVol® internally, please contact your distributor or local SGE Analytical Science office for service advice.

CAUTION

Always turn off power and unplug the Universal Power Supply before cleaning the exterior. Fluid seepage can damage internal components.

CAUTION

Do not immerse the eVol® into a cleaning solution or spray cleaning solution directly onto the exterior body of the eVol® as this can potentially damage the internal electronics.

LIMITED WARRANTY

eVol® is warranted to meet stated quality and performance specifications. It is also warranted to be free of defects in material or workmanship for a period of 1 (one) year from the date of purchase. The warranty implies free replacement of a defective product or component only upon documented evidence of the defect and upon authorized return of the defective item. It does not apply to mishandling of product either in use or in storage, nor to claims made after the warranty period has elapsed.

No other warranty or representation is expressed or implied by SGE for its products with respect to merchantability, fitness for any particular use or purpose, or any other matter. SGE shall not, under any circumstances, be liable for any incidental, consequential, or compensatory damages arising from use of or in conjunction with its products. The maximum liability for breach of warranty shall be the invoice price of the product.

WARRANTY EXCLUSIONS

The warranty does not include items of a consumable nature or items that are broken during misuse or incorrect handling.

REGISTER WARRANTY

Please fill out the warranty registration form on the SGE eVol® website: **www.sge.com/eVol**

14 CERTIFICATIONS

Type	Certification Number	Description
Electrical	EN61000-3-2 EN61000-3-3	Harmonics and Flicker
	EN61326-1	<p>Immunity test requirements for equipment intended for use in measurement, control, and laboratory locations. This includes testing and a formal report to the following:</p> <p>EN61000-4-2 ESD EN61000-4-3 Radiated Immunity EN61000-4-4 EFT/Burst EN61000-4-5 Surge EN61000-4-6 Conducted Susceptibility EN61000-4-8 Magnetics EN61000-4-11 Dips/Dropouts</p>

Table 13. eVol® drive unit certifications.

15 SYRINGE SPECIFICATIONS

15.1 ACCURACY AND PRECISION

500 μL

Inaccuracy:

- $\pm 0.2\%$ for calibrated syringe at full scale
- $\pm 0.5\%$ for calibrated syringe at 10% scale
- $\pm 0.5\%$ for uncalibrated syringe at full scale

Precision:

- 0.3 % RSD at full scale
- 0.6% RSD at 10 % scale

50 μL

Inaccuracy:

- $\pm 0.2\%$ for calibrated syringe at full scale
- $\pm 0.5\%$ for calibrated syringe at 10% scale
- $\pm 1.0\%$ for uncalibrated syringe at full scale

Precision:

- 0.4 % RSD at full scale
- 0.8% RSD at 10 % scale

5 μL

Inaccuracy:

- $\pm 0.2\%$ for calibrated syringe at full scale
- $\pm 1.0\%$ for calibrated syringe at 10% scale
- $\pm 1.0\%$ for uncalibrated syringe at full scale

Precision:

- 0.5 % RSD at full scale
- 1.0% RSD at 10 % scale

Specifications are subject to change without notification.

The following information is accessible through the Help menu option on your eVol® Automated Analytical Syringe.

16.1 FUNCTION-BASED PROGRAMMING MODE HELP

Dispense Mode	Main Menu	Dispense Mode allows liquid transfers when aspirate and dispense volumes are equal.
	Run Screen	<ul style="list-style-type: none"> • Press RUN to start the current step. • Press back (⬅️) to return to previous menu. • Select Edit at step 1 to change Aspirate volume. <ul style="list-style-type: none"> - Right arrow (➤) for fine volume increments. - Left arrow (➤) for course volume increments. • Select Speed to change aspirate and dispense speed prior to any step (1 slowest to 10 fastest). • Press Purge to exit any program.
Repeat Dispense Mode	Main Menu	Repeat Dispense mode allows dispensing multiple aliquots of the same volume. Select the volume and number of dispenses.
	Run Screen	<ul style="list-style-type: none"> • Press RUN to start the current step. • Press back (⬅️) to return to previous menu. • Select Edit at step 1 to change Dispense volume, Last Dispense volume, and Count. <ul style="list-style-type: none"> - Right arrow (➤) to save changes. - Left arrow (➤) to select or edit a favorite volume. • Select Speed to change aspirate and dispense speed prior to any step (1 slowest to 10 fastest). • Use Pace to change dispense interval timing (None, 1 Slowest - 9 Fastest). <ul style="list-style-type: none"> - Press and hold the Run button to dispense automatically. • Press Purge to exit any program.

Manual Mode	Main Menu	Manual Mode allows manual control and measurement of aspirate and dispense volumes.
	Run Screen	<ul style="list-style-type: none"> • Press RUN to start the current program. <ul style="list-style-type: none"> - Keep the Run button pressed to aspirate. - Release the Run button to stop aspirating. • Press back (⬅️) to return to previous menu. • Select Direction to alternate between Aspirate and Dispense functions. • Select Edit at step 1 to change Aspirate volume. <ul style="list-style-type: none"> - Right arrow (➤) for fine volume increments. - Left arrow (➤) for course volume increments. • Select Speed to change aspirate and dispense speed prior to any step (1 slowest to 10 fastest). • Press Purge to exit any program.

16.2 CUSTOM STEP-BASED PROGRAMMING MODE HELP

Main Menu Help	<p>Custom programs allow creation of up to 10 unique programs using four basic functions; Aspirate, Dispense, Mix and Purge. Programs can contain a maximum of 98 individual steps.</p> <ul style="list-style-type: none"> • Select Options to edit, delete, or copy an existing program.
Run Screen Help	<ul style="list-style-type: none"> • Press RUN to start the current program. • Select Edit at step 1 to add, edit, or delete a step in an existing program. • Use Speed to change aspirate, dispense or mix speeds prior to any step (1 slowest to 10 fastest). • Select New to create new custom programs. • Press Purge to exit any program.
Options Menu Help	<ul style="list-style-type: none"> • Select View/Edit to view or edit any existing program. • Select Delete to delete the program. • Select Copy to copy the entire program. • Use right arrow (➤) to run the program. • Select Name to rename the program.

16.3 TOOL BOX HELP

Toolbox provides options for calibration, storing owner information and setting other personal Preferences.

Syringe	Use this to manage your syringes, you can change the installed syringe or add, edit, delete and copy syringes	
Calibration	Calibration	<ul style="list-style-type: none"> • Select Target Volume to choose a volume to calibrate. • Select Actual Volume to enter the actual average volume from weighing. • Use Left arrow (<) key to calculate a new calibration factor and the right arrow (>) key to save the new calibration factor.
	Calibration Reminder	<ul style="list-style-type: none"> • Select Turn Timer On to activate reminder mode. • Select Remind in to select the number of months before next reminder alert. • Select Reset to reset the clock for Calibration Reminder.
	Service History	<ul style="list-style-type: none"> • Service History contains all service records and data provided by SGE Analytical Science.
Re-Zero	From time to time, as the syringe is used, it may be necessary to Re-Zero the syringe. This should be done if you notice an increasing gap between the plunger tip and the end of the syringe.	
Methods	Use this to manage your syringe methods, you can add, edit, delete and copy syringe methods.	

Preferences	Sound	<p>Use Sound to turn On/Off beep tones at:</p> <ul style="list-style-type: none"> • Completion of a step. • End of program. • When purge is pressed. • Error message prompt. • Touch wheel movement. • On last dispense in repeat dispense mode.
	Display	<p>Use Display to customize the following:</p> <ul style="list-style-type: none"> • Start Up Display. Choose the Safety Warning or None. • Display Dimming Time (1-20 minutes or Never). • Turn Off Time (5-20 minutes or 1 hour).
	Main Menu	<p>Use Main Menu to turn On/Off menu items that will appear in the Main Menu.</p> <ul style="list-style-type: none"> • Use the OK key to change status between On and Off.
	Touch Wheel	<p>Adjusts the sensitivity of the touch wheel, use this to fine tune to your touch.</p>
	Purge Key Speed	<p>Adjusts the speed of the dispense when the purge key is pressed.</p>
Owner Information	<ul style="list-style-type: none"> • View the Operator Identification (ID), Serial Number (S/N), Version and Model. • Select Edit to change the unique User ID. 	
Help Language	<p>You can select the appropriate help language. Available languages are English, French, German, Japanese Simplified Chinese and Spanish.</p>	

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