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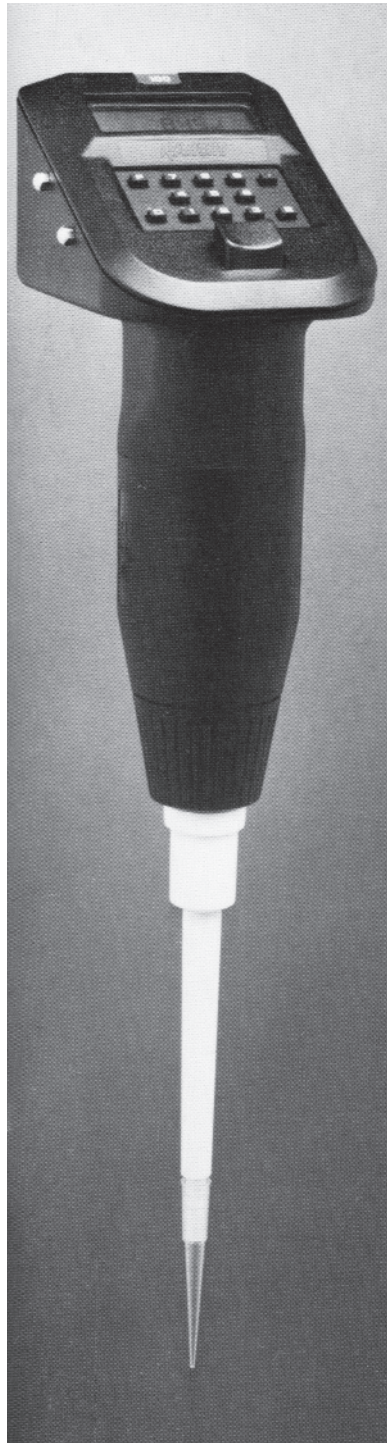
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EDP™

Electronic Pipette



Six pipettes for volume ranges from 0.5 µL to 2.5 mL

100 µL model shown

RAININ

Foreword

For best results, read this manual completely before using your EDP Electronic Pipette.

WARNING:
This equipment generates and uses radio frequency energy and if not installed and used properly, i.e., in strict accordance with the instructions manual, may cause harmful interference to radio communications. It has been tested and found to comply with the limits for a Class A computing device pursuant to Subpart J of Part 15 of FCC Rules, which are designed to provide reasonable protection against such interference when operated in a commercial environment.

Operation of this equipment in a residential area is likely to cause interference, in which case the user at his own expense will be required to take whatever measures may be required to correct the interference.

Prices and specifications are subject to change without notice. "EDP", "RAININ Certified" and "Clean-Pak" are trademarks of Rainin Instrument, LLC. EDP Pipettes are manufactured under U.S. Patent Nos. 4,671,123. Other U.S. and national patents issued and pending. Copyright 1984-2003, Rainin Instrument, LLC.

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1. DESCRIPTION

RAININ EDP Electronic Pipettes measure liquid volumes from one to 2500 microliters accurately and precisely. Volume measurements may occur in any of four different modes: **PIPETTING**, **DISPENSING**, **TITRATING**, and **DILUTING**.

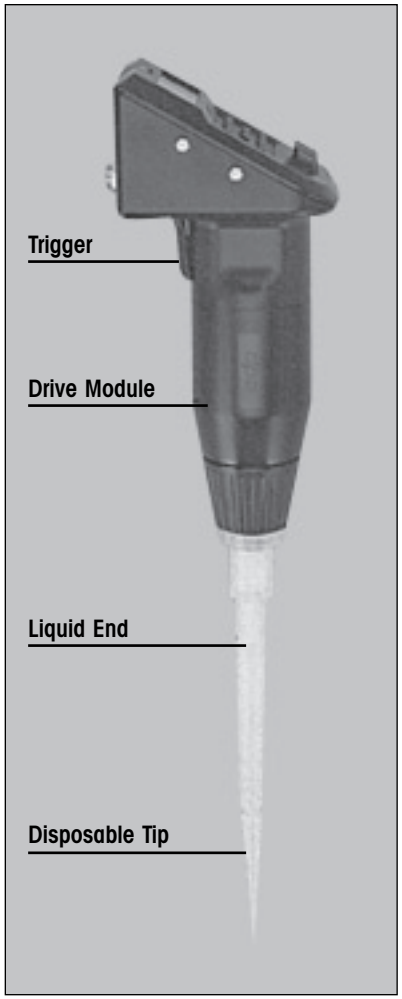


FIGURE 1.1
DRIVE MODULE, TRIGGER,
LIQUID END, DISPOSABLE TIP



FIGURE 1.2
ENCODER PLUG, DISPLAY,
KEYBOARD, TIP EJECTOR BUTTON

Six EDP models have nominal volume ranges of 10, 25, 100, 250, 1000, and 2500 microliters, respectively. Actual volumes are adjustable and may be changed rapidly and effortlessly by simple keyboard entries. The recommended working range for each model is 10% to 100% of the nominal volume range.

Each model consists of an electronic drive module and a replaceable liquid end. All six models incorporate the same electronic drive module. The liquid ends are interchangeable and may be purchased separately.

Each liquid end contains a precisely machined and polished chrome-plated stainless steel piston which moves up and down during volume measurements. The distance moved determines the volume measured.

The chamber below the piston connects to a disposable polypropylene tip via a column of air. The disposable tip is the only part of the instrument touching the liquid. Tips are easily changed between samples to avoid carryover.

The drive module controls the movement of the piston. Power for movement is supplied by a special electronic linear actuator. An on-board microcomputer-on-a-chip monitors the position of the piston and sends commands to the actuator. The position of the piston at the beginning and end of each stroke is controlled solely by the microcomputer. There are no mechanical stops.

The microcomputer communicates operating parameters and status to the user via a liquid crystal display and a tone generator. It receives commands from the user via a 13-key keyboard and is activated by a convenient pistol-grip trigger.

Power for the EDP pipette can be supplied either via a lightweight cord from a miniature wall transformer power supply or, for fully portable operation, from the optional Portable Power Pack accessory which mounts in a compartment in the drive module. The Portable Power Pack can be recharged by connecting the wall transformer. The pipette can be operated from the transformer while charging.

Alternately, the EDP pipette with Portable Power Pack installed can be recharged by placing it on the Rapid Charge Stand accessory. The Rapid Charge Stand provides a convenient resting place for the pipette when not in use.

2. UNPACKING INSTRUCTIONS

In addition to this instruction manual, the EDP package should contain

1. The EDP Electronic Pipette

2. The wall transformer

Carefully remove each part from the package and inspect for shipping damage. If any part appears to have been damaged in shipment, a damage claim should be filed immediately with the shipping carrier. Rainin Instrument LLC can assist you in filing a claim.

Be sure to save the shipping container and all packing materials until the instrument has been checked out and found to function properly.

To operate the EDP pipette, first plug the wall transformer into a convenient power outlet (105–130 volt, 50–60Hz or 210–260 volt, 50–60Hz, matching the specification printed on the transformer). Then plug the power cord from the transformer into the receptacle provided on the back of the EDP drive module.

As power is connected, you should feel the drive module begin to purr and move. The instrument will execute an initialization routine to properly position the piston for liquid measurement. The movement will stop after about 8 seconds, and the instrument will be silent. At this time, the digital volume display on the LCD panel should become visible. Should these initial events fail to occur, consult the troubleshooting information in Section 17 of this manual.

Attach a disposable tip to the liquid end by pressing the shaft into the tip with a firm twisting motion.

The EDP pipette is now ready for use.

NOTE:
If you have purchased the optional Portable Power Pack accessory, the Power Pack may be installed in the EDP drive module and the instrument can then be operated without the power cord attached. Before installing the Power Pack, it is a good idea to operate the EDP pipette under power from the wall transformer a few times to be sure that everything is functioning properly.

3. INSTALLING PORTABLE POWER PACK

When you are ready to install the Portable Power Pack, first disconnect the transformer cord from the instrument. Then remove the cover from the power pack compartment. The compartment is located at the rear of the drive module next to the power cord receptacle.

Plug the cord on the Power Pack into the cord from the pipette, which you should have found inside the compartment. Be careful to connect the two halves of the plug in the proper orientation. The plug is designed so that it can only be connected one way. Improper connection could result in damage to either the Power Pack or the EDP pipette.

When the Power Pack is connected, the instrument should purr, move, and execute the 8-second initialization sequence exactly as it did when power was first applied from the wall transformer. If this does not occur but the pipette was operating properly when powered by the wall transformer, the Power Pack may have discharged during storage and transit. See Section 11 of this manual for recharging instructions.

Fold the cord so that the plug is positioned neatly on top of the Portable Power Pack. Slide the Power Pack into the compartment with the excess cord to the right as shown in Figures 3.1 and 3.2.

Once the Power Pack has been installed and fitted snugly in its compartment on the EDP drive module, replace the compartment cover.

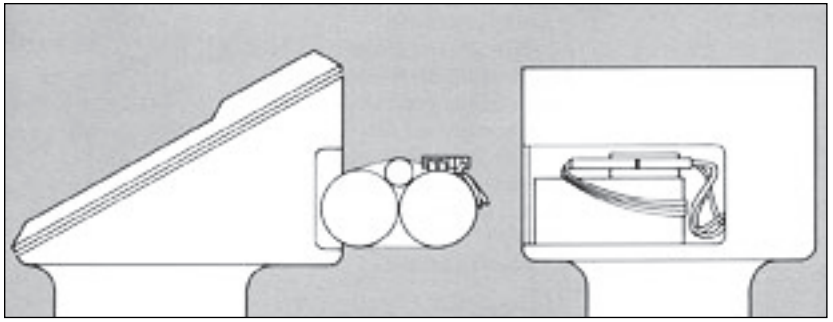


FIGURE 3.1
POSITION PLUG ABOVE
POWER PACK

FIGURE 3.2
POSITION EXCESS CORD
TO THE RIGHT

4. LIQUID MEASUREMENT MODES

The EDP Electronic Pipette can operate in four distinct liquid measurement modes, described in Table 4.1.

When power is first applied, or after changing the liquid end, the EDP pipette defaults to the **PIPETTE** mode.

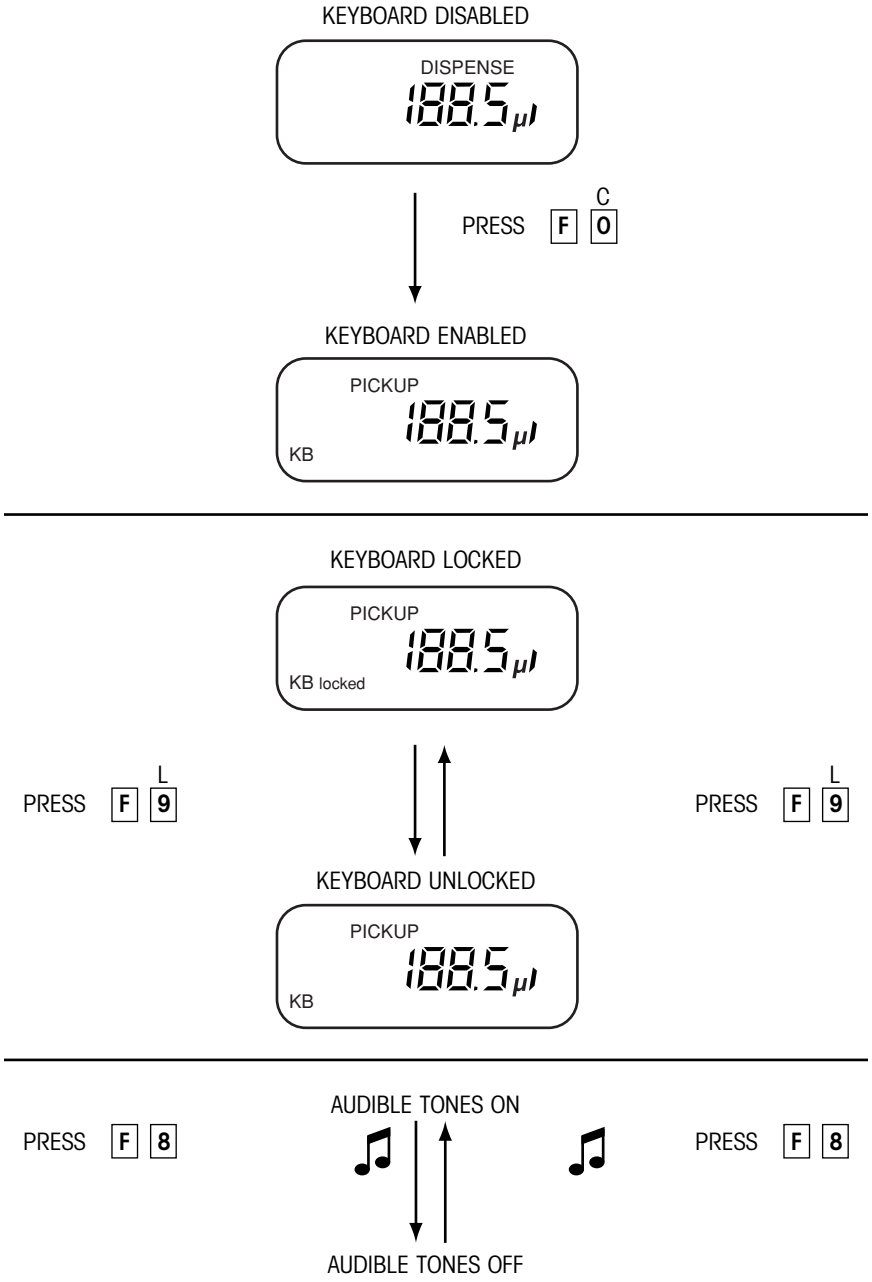
The mode may be changed whenever the keyboard is active. The keyboard is active when the symbol "KB" is visible at the lower left of the display and the word "locked" is absent. If the keyboard is not active, see Section 5.

To change the mode, press the FUNCTION key [F] followed by the appropriate numeric key as indicated in Table 4.1.

Table 4.1

MODE	DESCRIPTION	TO SET	DISPLAY SHOWS
#1) **PIPETTE**	A single volume of liquid is aspirated, then dispensed.	Press [F] [1] (P)	(blank)
#2) **MULTIDISPENSE**	A single volume of liquid (V1) is aspirated, then partially dispensed stepwise as a series of equal but smaller volumes (V2).	Press [F] [2] (M)	**M**
#3) **TITRATE**	A single volume of liquid (V1) is aspirated, then partially dispensed under user control. A smaller volume (V2) may be specified to be dispensed immediately. During dispensing, the display shows the total volume dispensed.	Press [F] [3] (T)	**T**
#4) **DILUTE**	Two separate volumes (V1, V2) of different liquids are aspirated sequentially, separated by a small air segment. Both liquids are dispensed together. Volume V1, the diluent, is usually larger than volume V2, the sample.	Press [F] [4] (D)	**D**

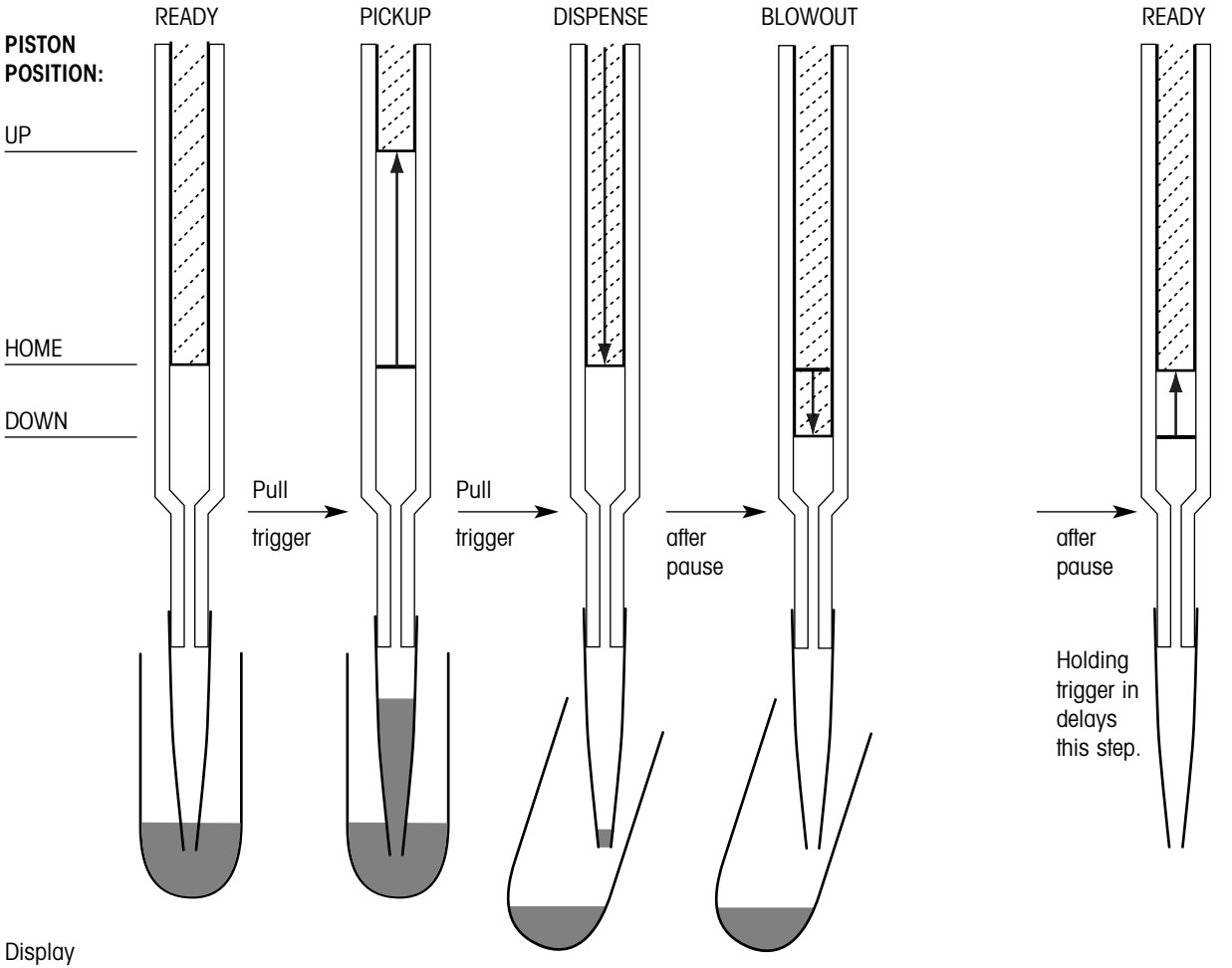
5. QUICK REFERENCE: GENERAL



Keyboard entries other than those shown on this page will be accepted only when the keyboard is **enabled** and **unlocked.**

6. QUICK REFERENCE: PIPETTE MODE (#1)

OPERATION:



TO SET MODE

Press F P 1

TO SET VOLUME

Press 1 5 . 0 E

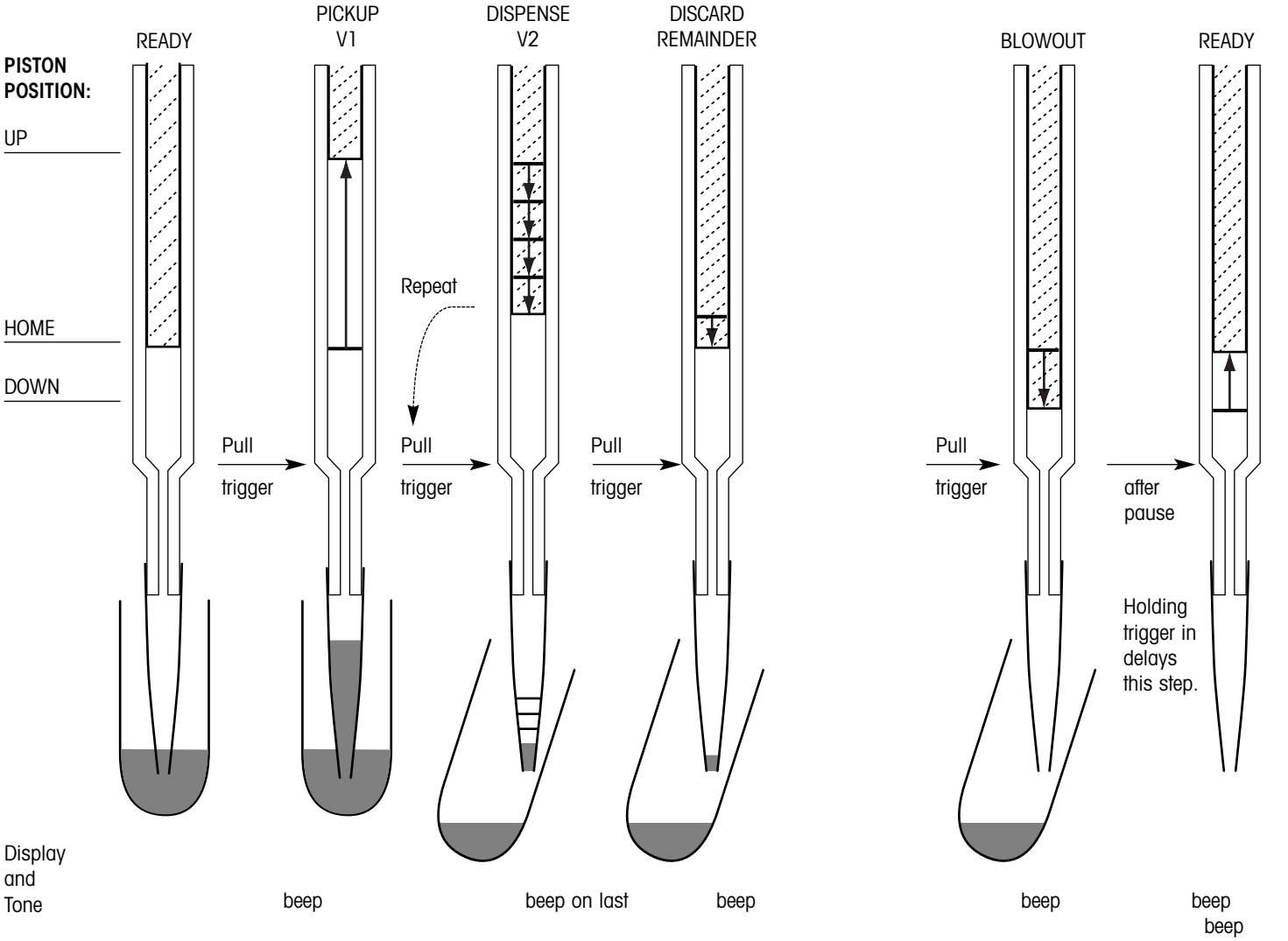
(Desired volume)

TO CLEAR, EMPTY, OR RETURN HOME

Press F C 0

7. QUICK REFERENCE: MULTIDISPENSE MODE (#2)

OPERATION:





TO SET MODE

Press F M 2

TO SET NEW VOLUMES

V1: Press 1 0 0 0 E
(Desired pickup volume)

V2: Press 2 1 0 E
(Desired dispense volume)

TO RE-ENTER SAME VOLUME

V1: PRESS E

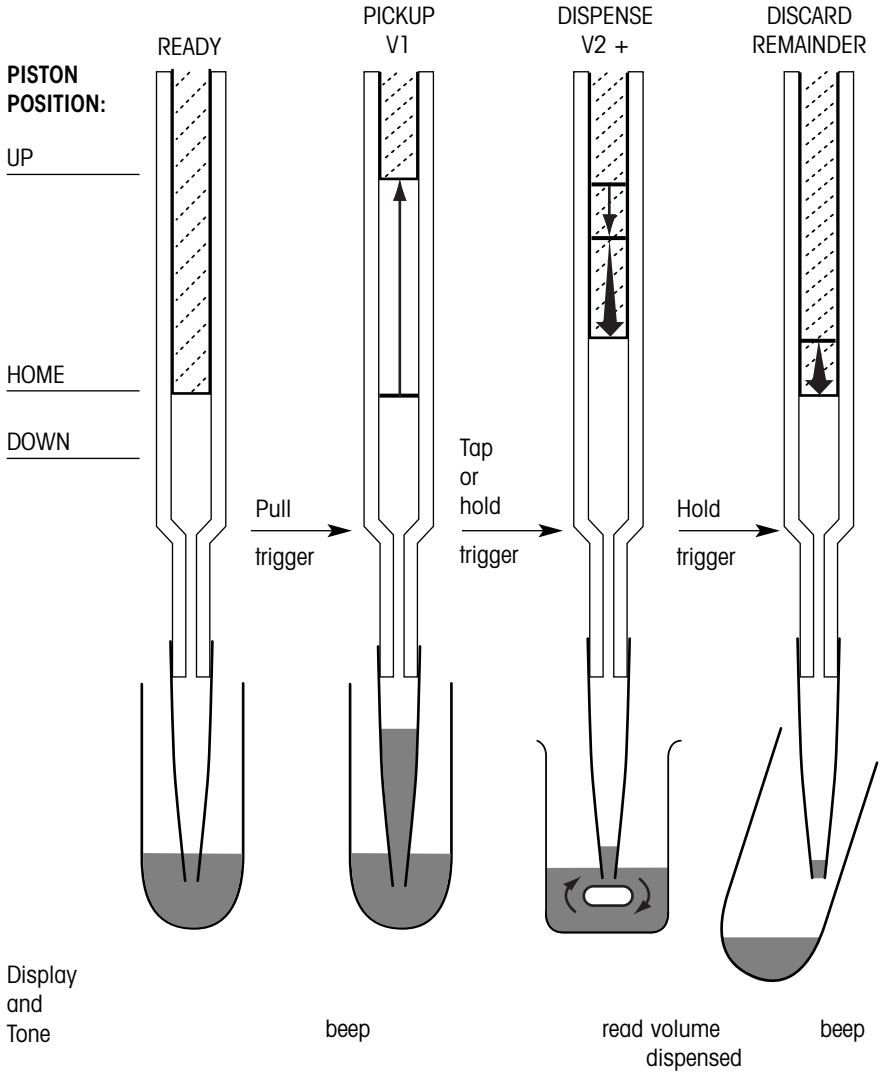
V2: PRESS E

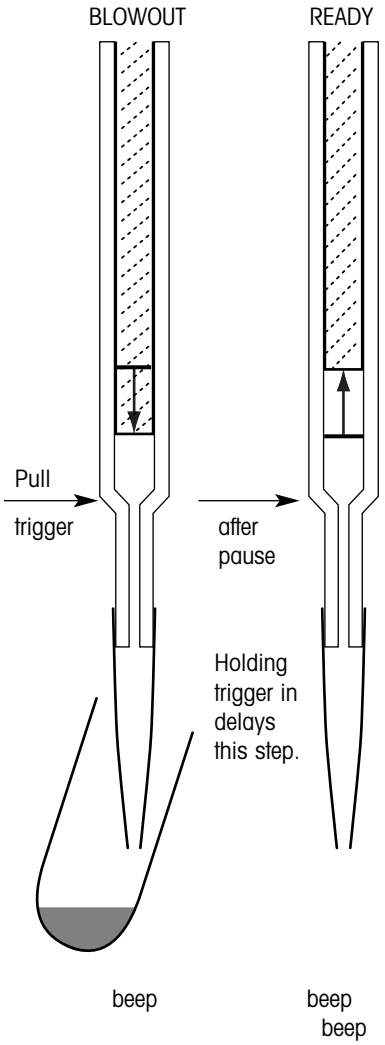
TO CLEAR, EMPTY, OR RETURN HOME

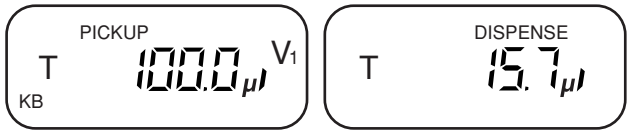
Press F C 0

8.0 QUICK REFERENCE: TITRATE MODE (#3)

OPERATION:







TO SET MODE

Press [F] [T 3]

TO SET NEW VOLUMES

V1: Press [1] [0] [0] [.] [0] [E]
(Desired pickup volume)

V2: Press [1] [5] [.] [7] [E]
(Desired initial dispense volume)

TO RE-ENTER SAME VOLUME

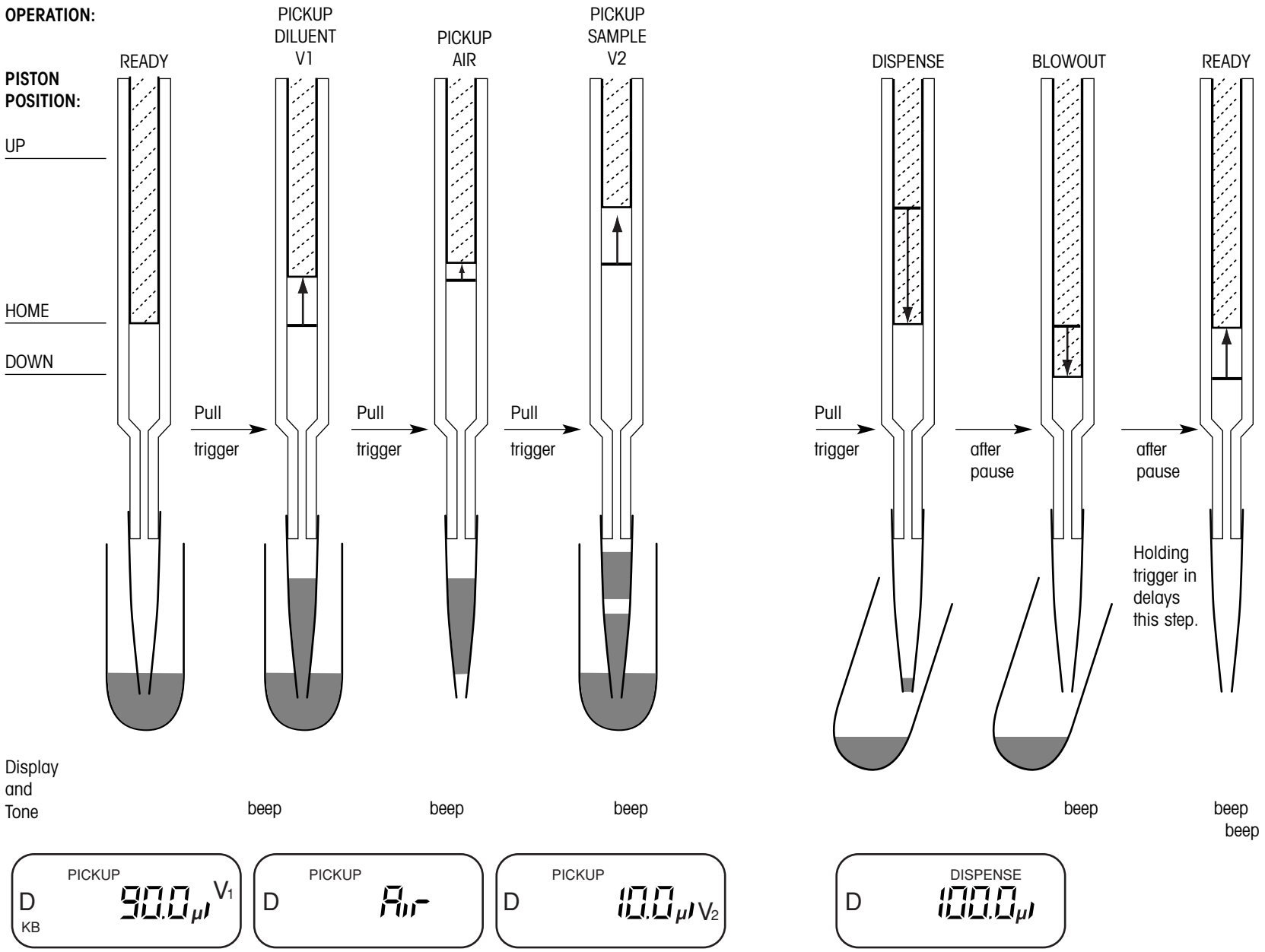
V1: PRESS [E]

V2: PRESS [E]

TO CLEAR, EMPTY, OR RETURN HOME

Press [F] [C 0]

9. QUICK REFERENCE: DILUTE MODE (#4)



TO SET MODE

Press [F] [D 4]

TO SET NEW VOLUMES

V1: Press [9] [0] [.] [0] [E]
(Desired diluent volume)

V2: Press [1] [0] [.] [0] [E]
(Desired sample volume)

TO RE-ENTER SAME VOLUME

V1: PRESS [E]

V2: PRESS [E]

TO CLEAR, EMPTY, OR RETURN HOME

Press [F] [C 0]

10. QUESTIONS AND ANSWERS

Q #1:
Is it necessary to enter the decimal point when setting a volume?

A:
No. If the volume is a whole microliter, the decimal point and zeros following it need not be entered. In fact, with the nominal 1000 and 2500 microliter instruments, all possible volume settings are whole microliters, and the decimal point is not displayed. If the decimal point is pressed when setting a volume on either of these instruments, all following digits will be ignored.

Q #2:
What is the smallest possible increment in a volume setting?

A:
For 10, 100, and 1000 microliter instruments, the smallest possible increment in a volume setting is 1/1000 of the nominal range of the instrument. For 25, 250, and 2500 microliter instruments, the smallest increment is 1/500 of the nominal range. With the 25 microliter instrument volume settings are rounded down to the next lower 0.00 or 0.05 microliter. With the 250 microliter instrument volume settings are rounded down to next lower 0.0 or 0.5 microliter. The 2500 microliter instrument rounds down to the next lower multiple of 5 microliters.

Q #3:
Since all EDP models have the same electronic drive module, how does the drive module know the nominal volume of the liquid end attached?

A:
The encoder plug in the head of the drive module must match the liquid end. It is the user's responsibility to verify this. **Whenever the liquid end is changed, the encoder plug must also be changed.** A good way to check for the correct volume is to observe the LCD display following the 8-second initialization sequence after the encoder plug is inserted. The numeric display should show the nominal volume of the liquid end.

WARNING:
When changing the encoder plug, the keyboard must be "unlocked." Removing or changing the encoder plug when the keyboard is locked has no effect, and could result in measurement errors if a different liquid end has been attached.

Q #4:
What happens if no encoder plug is present?

A:
If the keyboard is not locked the numeric display will show "– – –" and the instrument will not operate. If the keyboard is locked, the instrument will behave as if the previously present encoder plug were still in place.

NOTE:
If the EDP instrument is to be operated at a single volume setting for a large number of tests, this feature can be used to ensure that the volume setting can not be accidentally changed. Simply set the volume desired. Then lock the keyboard, remove the encoder plug, and store it in a safe place. The instrument will operate properly only at the previously set volume. If the keyboard is unlocked, the instrument will not function until the encoder plug is reinserted.

Q #5:
Does the EDP pipette remember volumes?

A:
Yes. Once a volume setting has been specified in any of the four operating modes, that setting will be remembered and used until it is changed by keyboard entries from the user. For example: An instrument in the **PIPETTE** mode is set to measure 75 microliters. The instrument is then used in the **DILUTE** mode to mix 90 microliters of diluent with 10 microliters of sample. If the instrument is returned to the **PIPETTE** mode, it will be ready to again measure 75 microliters without further keyboard entries. When the instrument is next placed in the **DILUTE** mode, it will still be set to aspirate 90 microliters of diluent and 10 microliters of sample.

This retention of previous volume settings applies to every mode, regardless of how many other modes have been used in between, as long as power has been applied to the instrument continuously and the encoder plug has not been removed. Removing power from the instrument will result in loss of volume settings from memory. The instrument will initialize to its default values when power is restored.

Q #6:
What does it mean when the volume indicator on the display is flashing?

A:
If the keyboard is enabled (symbol "KB" showing at lower left of display), a flashing volume display means a volume entry is in progress or is being called for. In modes requiring two volumes, the symbol "V1: or "V2" at the right of the display tells you which volume is being called for. The volume entry sequence must be completed before the instrument can be used for measurements.

Q #7:
How can an erroneous volume entry be corrected?

A:
If the "enter" key has already been pressed and you are in the **PIPETTE** mode, simply repeat the volume entry with the correct volume. If you are in any mode other than the **PIPETTE** mode, press the "enter" key a second time, then repeat the volume entry.

If the "enter" key has not yet been pressed when you discover your mistake, pressing the sequence F 0 clears the erroneous entry and causes the display to flash the previous volume setting. The correct volume can now be entered.

Q #8:
What happens if the volume entered is an illegal value?

A:
The instrument will emit a warbling sound, the volume display will show the message "Err" for approximately one second, and the illegal volume will not be accepted. The user must proceed by entering a legal value.

The following volume entries are illegal:

(1) Any volume greater than the nominal full-range volume.

(2) Zero, or any volume less than the smallest incremental volume.
(Exception: In the **TITRATE** mode, zero is a legal value for V2.)

(3) In the **MULTIDISPENSE** and **TITRATE** modes, any volume V2 greater than V1.

(4) In the **DILUTE** mode, any volume V1 or V2 which causes the sum V1 + V2 to exceed 101% of the nominal full-range volume.

WARNING:
In the **MULTIDISPENSE** and **TITRATE** modes, a possible trap exists if V1 has been inadvertently set to a very small value, especially if the user cannot remember what value was entered for V1. In this case, almost any value for V2 will be illegal and the drive module will repeatedly give the error signal for every volume entered. If this situation should occur, it can best be corrected by entering the smallest possible value for V2. The smallest possible value would be 1/1000 of the nominal full scale volume (1/500 for 25, 250, and 2500 microliter instruments). The display should now return to V1, and permit a legal volume entry sequence to be executed.

The same difficulty may occur in the **DILUTE** mode if the value entered for V1 is very close to the nominal full-scale volume of the instrument. The solution is the same: Enter the smallest possible value for V2 to escape, then enter the desired legal values for V1 and V2.

Q #9:
How do I know when the Power Pack needs recharging?

A:
The instrument will intermittently warble and display the message "Lob" on the volume display. When this occurs, the Power Pack should be recharged by placing the instrument on the Rapid Charge Stand or by attaching the wall transformer. If the wall transformer is used, operation of the instrument may continue with the cord attached.

In no case should the instrument continue to be operated without recharging when the low battery signal arises, since accurate measurements cannot be guaranteed under these conditions. Also, if the charge on the Power Pack becomes sufficiently low, an initialization sequence may occur. In this event, any stored volume specifications will be lost and must be re-entered.

Q #10:
What does it mean if I try to enter a volume and nothing happens?

A:
Normally, you will know that the EDP drive module is accepting a volume entry because the digital volume indicator begins to flash as soon as the first numeric key is pressed. If this does not occur, it is probably because the keyboard is locked or the keyboard is not enabled. Check the lower left portion of the display for the letters "KB" and the absence of the word "locked." See Section 4 for toggling procedures.

Continued ...

The keyboard lock is for protection. When the EDP pipette is used to repeat the same program over a long period of time, locking the keyboard eliminates the possibility of unwanted volume or mode changes.

Q #11:
Why should the last aliquot be discarded in the MULTIDISPENSE mode?

A:
If V1 is not a perfect multiple of V2, then the final aliquot will be smaller than all the rest. Also, even if V1 is a perfect multiple, the last aliquot will be less accurate than all the others.

Q #12:
How do I know when I have reached the last aliquot in a MULTIDISPENSE sequence?

A:
When the next-to-last aliquot has been dispensed, the tone generator will beep, and the symbol "V2" will disappear from the right side of the display. If the last aliquot is smaller than all the others, the volume indicator will change to display this smaller volume. The last aliquot is normally discarded.

Q #13:
What happens when I dispense in the TITRATE mode?

A:
First, if a non-zero value was set for V2, the V2 symbol will appear on the volume indicator and this volume will be dispensed quickly the first time the trigger is pulled.

Next, or if V2 was zero, pulling the trigger will cause the piston to start moving downward slowly. If the trigger is held in, the rate of movement of the piston will accelerate gradually, increasing the rate at which liquid is dispensed, until a maximum rate is reached. You can feel this in the movement of the actuator as you operate the pipette.

If the trigger is released, then pressed again, the sequence of events repeats. First slow movement, then gradual acceleration to a maximum. This allows you to approach an endpoint rapidly by holding the trigger, or very gradually by tapping the trigger so that the piston always moves downward very slowly.

At all times during the dispense cycle, the volume display records the total volume dispensed.

In titrating to an endpoint, it is always best to dispense with the end of the disposable tip actually immersed 2-3 mm into the liquid in the receiving vessel. This promotes immediate mixing and avoids endpoint errors.

Q #14:
How can I empty the remaining liquid from the tip rapidly after dispensing only a portion of the aspirated volume in the MULTIDISPENSE or TITRATE mode?

A:
Press the key sequence F 0. This will cause the piston to immediately move down, emptying the tip. Then after a brief pause, the instrument will execute a blowout cycle, and the piston will return to the home position and be ready to pick up the next sample.

Q #15:
What is the purpose of the air segment in the DILUTE mode?

A:
It prevents contamination of the sample in its original container by diluent. If you wish, you can wipe the outside of the tip after the air segment stroke before aspirating the sample.

Q #16:
Can the EDP pipette be used for "reverse-mode" pipetting of serum, plasma, and other liquids of moderate viscosity?

A:
Yes. Use the **MULTIDISPENSE** mode with V1 set to a slightly higher volume than desired, and V2 set to the desired volume. The pickup cycle will then aspirate a slight excess of liquid. The first press of the trigger in the dispense cycle will dispense the desired volume. The second press will dispense the excess, to be discarded. The third press will initiate the blowout cycle and return the piston to the home position.

Q #17:
Can the EDP pipette be used to measure the volume of liquid in a container?

A:
Yes, if you know approximately how much liquid is present. Place the EDP pipette in the **TITRATE** mode and set V1 to the approximate volume and V2 to zero. Now pick up the liquid in the container.

If all the liquid was not picked up, the volume approximation was too small. Dispense the liquid back into the container, reset V1 to a higher approximate volume, and try again.

If all the liquid was picked up, check the tip to see if there is an air segment below the liquid. Hold or quickly squeeze and release the trigger until the air has been expelled and the liquid in the tip just reaches the orifice. Read the volume indicator and subtract this reading from V1 to get the actual volume of liquid present. After taking the reading, hold the trigger or press F O to return the liquid in the tip to the container.

11. CHARGING THE POWER PACK

Operating the EDP Electronic Pipette with the Portable Power Pack installed provides maximum freedom of movement and ease of use.

At the option of the user, the EDP pipette may also be operated with the Power Pack removed and the wall transformer connected. This has the advantage of providing a slight reduction in weight, which may be desirable for long uninterrupted liquid measurement procedures. However, portability is limited, and operating the pipette with the cord attached requires more care and coordination. Also, any interruption of line current when operating without the Power Pack will cause all stored volumes to be lost from memory. The pipette will execute the 8-second initialization sequence when power is restored. Any liquid held in the tip at the time power is interrupted will be dispensed during the initialization sequence. For these reasons, operation with the Power Pack installed is recommended.

With the Power Pack installed, the electronic drive module should always be connected to a charger when not in use. This will assure that the Power Pack is well charged and minimize instances of discharge during use.

If the instrument will be stored without using for an extended period, the Power Pack should be fully charged and then removed. This will prevent discharge during storage. Whenever the Power Pack is installed, the drive module is "on". Even though the actuator is not moving the piston, there is a continuous small power consumption by the micro-computer electronics.

If the Power Pack becomes discharged during operation of the instrument, the drive module will emit an audible warble and the message "Lob" will appear in place of the volume on the numeric display. Whenever this occurs, the instrument should be attached to a charger immediately after completing the current pipetting cycle. If the wall transformer is used, operation of the instrument may continue without interruption after a few seconds.

The Portable Power Pack can only be recharged while it is installed in an EDP drive module.

Recharging is Simple:

With the **wall transformer**, simply plug the transformer cord into the receptacle on the drive module. Be sure the transformer is plugged into an active AC receptacle which supplies power matching the specification on the charger (105–130V, 50–60Hz for domestic models). A totally discharged Power Pack will be completely charged in approximately 14 hours.

A more elegant way to charge the EDP Power Pack is to use the accessory **Rapid Charge Stand**. The Stand provides a convenient resting place for the EDP pipette. Whenever the instrument is placed on the stand, charging occurs automatically via the special external contacts on the sides of the drive module. While the instrument is being charged on the Stand, the symbol "FC" will appear on the display, and all functions are inoperative. Operation may be resumed as soon as the instrument is removed from the Stand

The Rapid Charge Stand delivers current to the Power Pack much more rapidly than the wall transformer. A totally discharged Power Pack can be completely charged in 1-1/2 hours. Special circuitry in the Stand meters current and monitors the temperature of the Power Pack battery via a temperature probe contained in the Power Pack itself. The Stand delivers current under carefully controlled conditions which assure that damage to the Power Pack will not occur.

When the Power Pack is fully charged, the red "rapid charging" light goes off and the Rapid Charge Stand delivers a small maintenance current that allows the EDP pipette to be safely left on the stand for as long as desired.



FIGURE 11.1
CONNECTING THE
WALL TRANSFORMER

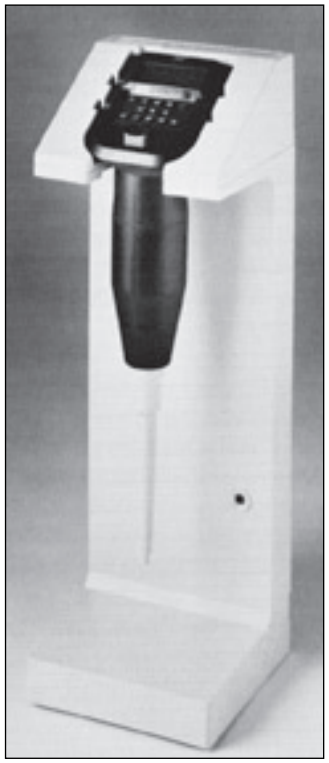


FIGURE 11.2
RAPID CHARGE STAND WITH
EDP PIPETTE IN PLACE

12. DISPOSABLE TIPS

The requirements for disposable pipette tips are fairly demanding.

Tips must seal properly on the EDP shaft and must be flexible and smooth on their interior surfaces so that the shaft is not damaged.

Tips must be free of flash and particulates. Microscopic flash at the orifice can limit precision and accuracy by causing unwanted retention of liquid by the tip. Also, the orifice must be the correct size and consistent in size and geometry from tip to tip.

Both interior and exterior surfaces must be clear, smooth, and hydrophobic to avoid unwanted retention of liquid as droplets or film which can reduce accuracy and reproducibility.

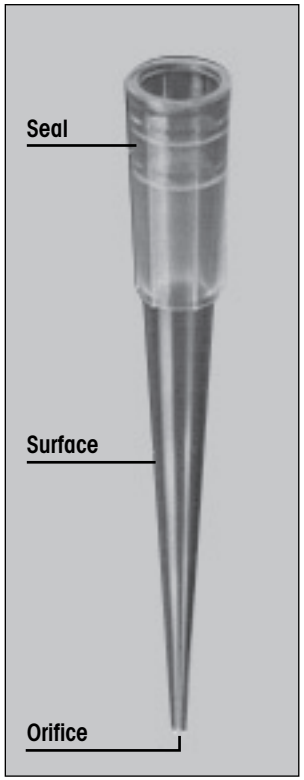


FIGURE 12.1
RAININ CERTIFIED TIP:
SEAL, SURFACE, ORIFICE

RAININ EDP Electronic Pipettes are designed and calibrated for use with RAININ Certified™ Disposable Tips. Performance to specification by EDP Pipettes is guaranteed only when RAININ Certified Tips are used as recommended. Rainin Instrument LLC accepts no responsibility for damage to EDP Pipettes or for poor liquid measurement performance resulting from use of non–standard pipette tips of inferior quality.

RAININ Certified Tips are molded from the highest quality virgin polypropylene plastic. Only the finest molds and the best possible molding procedures are used. Molds are inspected and maintained regularly to assure conformance with high quality standards. Samples from each lot of tips are inspected microscopically to assure that every lot meets these standards.

Tips for use with EDP are:

Model	EDP-10	EDP-25	EDP-100	EDP-250	EDP-1000	EDP-2500
Maximum Volume	10 µL	25 µL	100 µL	250 µL	1000 µL	2500 µL
Bulk Tip Cat. No.	RC-250	RC-250	RC-250	RC-250	RC-1000	RC-2500
Rack Tip Cat. No.	RT-250	RT-250	RT-250	RT-250	RT-1000	RT-2000
Presterilized Tip Cat. No.	RT-250S	RT-250S	RT-250S	RT-250S	RT-1000S	RT-2000S
SpaceSaver Cat. No.	GPS-250	GPS-250	GPS-250	GPS-250	GPS-1000	n/a
Green-Pak Cat. No.	GP-250	GP-250	GP-250	GP-250	GP-1000	n/a
StableStak Cat. No.	SS-250	SS-250	SS-250	SS-250	n/a	n/a
StableRak Cat. No.	SR-250	SR-250	SR-250	SR-250	n/a	n/a

13. HINTS FOR PROPER PIPETTING

EDP Electronic Pipettes are calibrated to deliver accurate volumes under the following conditions:

1. The liquid pipetted is water or any liquid with a density not significantly different from, a viscosity not significantly greater than, and a vapor pressure not significantly greater than that of water.
2. The temperature of the room, the pipetting instrument, and the liquid are all in the range 21.5°C ± 1°C.
3. The pipette is kept vertical during pipetting. During aspiration of sample the end of the disposable tip should be immersed 2 to 3 mm below the liquid surface.
4. There is no significant adherence of liquid to the surfaces of the disposable tip during pipetting. Each tip should be rinsed once before pipetting to assure the best accuracy.
5. The pipette tip is touching the wall of the receiving vessel during dispensing. The tip should be moved along the wall at the end of each dispensing step to remove any excess liquid outside the tip.

EDP Electronic Pipettes remove many of the operator variables from the pipetting process. Inaccuracies due to human error in locating the exact stop positions at the end of the piston stroke or in releasing or pressing the pushbutton too fast or too slow do not exist. So long as the above conditions apply, most operators will be able to obtain accurate and precise liquid measurements.

Even when conditions differ from the ideal, EDP pipettes can produce good liquid measurements. With liquids much denser than water, for example, the actual volume measured will be less than the setting on the pipette, but consistency from sample to sample will still be excellent. If absolute accuracy is important, the volume error can be compensated by applying a correction factor to the volume setting.

Continued …

Liquids of viscosity moderately higher than water, such as serum and plasma, can be measured accurately by using the reverse-mode pipetting strategy to aspirate a larger volume than is dispensed. (See Section 10, Question #16.) By pipetting in reverse-mode, residual liquid on the interior wall of the disposable tip becomes a less important factor in determining volumetric accuracy.

Warm and cold liquids can be measured with good accuracy and precision as long as a consistent pipetting rhythm is maintained from sample to sample in order to minimize differences in heating and cooling effects within the pipette. A new disposable tip should be used with each sample when measuring liquids with temperatures much different from ambient.

Maintaining a consistent pipetting rhythm is always a good idea. This will assure the best reproducibility from sample to sample.

In the **MULTIDISPENSE** and **TITRATE** modes, best results are obtained if all dispensing is performed without delay after aspirating the sample. Delays will exaggerate the effects of heat transfer if the temperatures of the sample, the instrument, and the room are not perfectly matched. This will decrease accuracy and precision.

14. CHANGING LIQUID ENDS

Any of the six available liquid ends can be rapidly mounted on the EDP Drive Module.

To remove the liquid end, first move the EDP pipette to the home position by pressing F O. The letters "KB" should be visible at the lower left on the display. If the keyboard has been locked, unlock it.

Now rotate the retainer ring counterclockwise until it is free and pull the liquid end away from the drive module. Remove the encoder plug from the head of the drive module and store this with the liquid end. Always disassemble each liquid end, inspect for salts and residues, and clean if necessary before storing for an extended period.

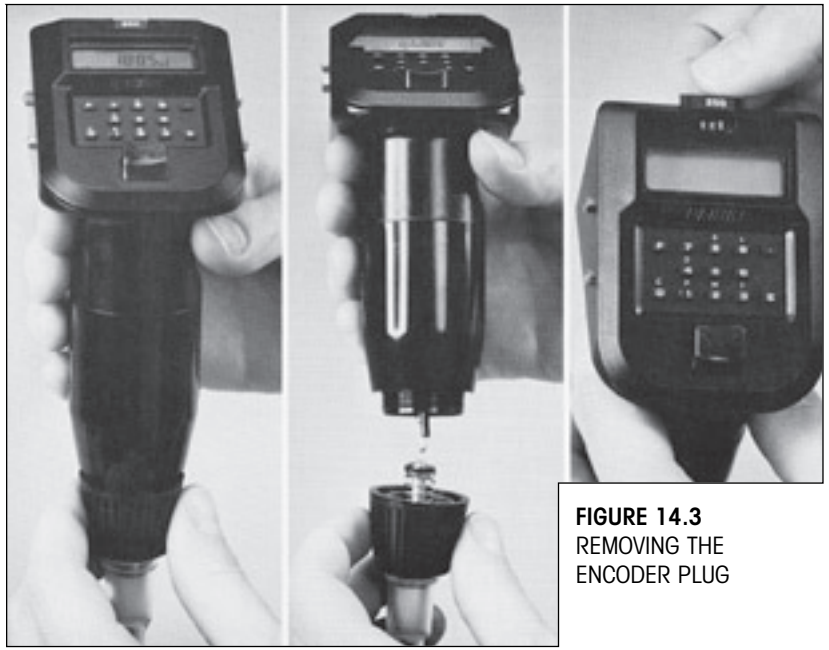


FIGURE 14.3
REMOVING THE
ENCODER PLUG

FIGURE 14.1
ROTATING THE
RETAINING SEAL

FIGURE 14.2
REMOVING THE
LIQUID END

NOTE:
When handling the encoder plug, do not touch the lower surface. Skin oil can contaminate the plug, leading to poor electrical contact and improper function. Should this occur, the situation can be corrected by swabbing the lower surface of the encoder plug with isopropanol.

CAUTION:
When attaching a new liquid end, always install the liquid end on the drive module before inserting the encoder plug. If the encoder plug is inserted while no liquid end is in place, the EDP pipette can not execute a valid initialization cycle.

To attach, first hold the liquid end vertical with its tip resting on a soft surface such as a book or paper towel. Move the drive module into place above the liquid end so the actuator pin of the drive module engages the seat on the piston retainer. Rotate the liquid end so the tip ejector hole in the shaft is directly below the tip ejector pin. Be sure the tip ejector pin passes through the hole. Engage the keyway in the liquid end with the key on the drive module. Press the drive module down snugly. Then thread the retainer ring carefully onto the drive module and tighten.

NOTE: The 2500 microliter liquid end has no tip ejector. Just engage the actuator pin, thread the liquid end carefully onto the drive module, and tighten. Store the retainer ring and tip ejector spring for future use with other liquid ends.

Remove the new encoder plug from the package. Check the labels on the plug and the liquid end and be sure the volumes match. Plug the encoder into the receptacle on the head of the drive module. As soon as the encoder plug is inserted, the EDP pipette should execute the 8-second initialization sequence, as if power had just been have been applied. (NOTE: The keyboard must have been unlocked for this to occur.)



FIGURE 14.4
ATTACHING THE LIQUID END

At the end of the initialization sequence, check the display. The instrument should be in the **PIPETTE** mode, and the volume indicator should show the nominal full-scale volume of the liquid end you have attached.

The instrument is now ready for use.

15. REMOVING THE TIP EJECTOR

Except for the 2500 microliter model, each EDP liquid end has an integral tip ejector, a movable cylinder surrounding the liquid end and extending up through the retainer ring. The tip ejector is operated by pressing the tip ejector button on the head of the drive module.

In certain applications requiring access to liquids in very deep, narrow containers, it may be necessary to operate the pipette without the tip ejector.

To remove the tip ejector, proceed initially as if you were changing the liquid end. The tip ejector is held in place by the same threaded retainer ring which attaches the liquid end to the drive module. Rotate the retainer ring counter–clockwise and remove the liquid end from the drive module. Then slip the retainer ring and the tip ejector off the shaft.

Leaving the tip ejector spring in place, replace the retaining ring on the liquid end without the tip ejector.

Finally, reattach the liquid end to the drive module.

Note that it is not necessary to remove the encoder plug from the drive module when removing the tip ejector. Thus any volume specifications in memory will be retained.

CAUTION:
Be careful not to press the trigger during this operation.



FIGURE 15.1
REMOVING THE TIP EJECTOR
FROM THE LIQUID END

16. CARE AND CLEANING OF LIQUID ENDS

For accurate liquid measurement, it is important to maintain the integrity of seals between the liquid end and the disposable tip and between the piston and the interior of the liquid end.

Each pipette should be checked periodically for proper sealing: Mount a disposable tip, set the instrument to its nominal full-scale volume in the **PIPETTE** mode, and aspirate that volume of water. Then hold the instrument in the vertical position and observe the tip for 1-2 minutes. During that period there should be no loss of liquid from the tip or droplet formation at the orifice.

For a proper seal between the liquid end and the tip, it is important to use only RAININ Certified™ or Clean-Pak™ disposable tips as recommended in Section 12 of this manual. These tips are designed for proper fit, with sealing surfaces matching the design of the pipette shaft and proper flexibility to ensure a good seal.

It is important to avoid nicking or scratching the sealing surface of the pipette shaft. Should the shaft become scratched and fail to produce an air-tight seal, this may sometimes be corrected by rotating the sealing surface of the shaft inside a small piece of very fine emery cloth. Take care during this procedure to remove only the minimum amount of material necessary to restore a proper seal. Should this measure fail, the shaft should be replaced.

The seal between the stainless steel piston and the interior of the pipette shaft is formed by a self-lubricating PTFE ring and a fluoroelastomer O-ring. The PTFE ring extends through the O-ring, and only the PTFE ring contacts the surface of the piston. (See Figure 16.1) The O-ring actually compresses the PTFE ring against the piston to maintain a proper seal even after moderate seal wear. The O-ring itself also forms the stationary seal between the PTFE ring and the shaft.

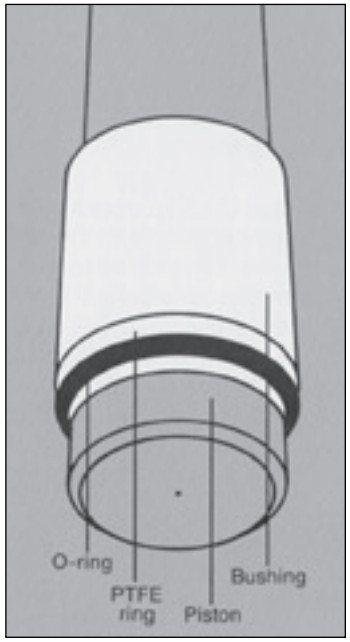


FIGURE 16.1
TYPICAL PISTON SEAL ASSEMBLY

The most important factor in maintaining the integrity of the piston seal is keeping it clean. Never allow liquid to enter the shaft where it can come into contact with the piston or the seal. The EDP pipette helps you by controlling the rate of upward movement of the piston to avoid splashing. In addition, whenever liquid is present in the pipette tip, the instrument should be held vertically. Never invert the instrument or lay it on its side with liquid in the tip. Never pull liquid into the shaft by operating the instrument without the proper disposable tip attached.

Periodically, the liquid end should be disassembled for inspection: First remove the liquid end from the drive module. (It is not necessary to remove the encoder plug during this procedure.) Now depress the spring-loaded piston retainer and rotate it counter-clockwise a fraction of a turn to disengage the retainer catch. Then pull the piston assembly out of the shaft. The seal will normally remain attached to the piston. If the seal is not attached to the piston, invert the shaft and tap it lightly until the seal drops out.

Inspect the piston, the seal, and the inside of the shaft for dirt and particulate contamination, especially salt residues. If any part is not perfectly clean, remove the contamination by rinsing with a good solvent such as distilled water or methanol. The surface of the piston should maintain a high polish, as when new. If this surface loses its polish or becomes scratched, corroded, or pitted, seal wear will accelerate drastically. If any of these conditions exist, the piston assembly should be replaced.



FIGURE 16.2
REMOVING THE PISTON ASSEMBLY FROM THE LIQUID END

Always allow the piston assembly and shaft to dry completely before reassembling. The piston may be dried with a very soft cloth. However, paper towels or any other material which may scratch the piston surface should not be used.

Before reassembling the liquid end, check the piston seal for wear by sliding it along the piston. The seal should offer a slight but definite resistance to movement on the piston. The seal should not fall down the piston under its own weight. If no resistance is observed, the seal should be replaced.

WARNING:
Never apply grease to the seal assembly of an EDP pipette. The PTFE seal is self-lubricating. Grease or lubricant residue will alter the effective diameter of the piston and produce errors in liquid measurement.

Reverse the procedure to reassemble the liquid end. Make sure the PTFE seal and O-ring are properly positioned on the piston. Compress the piston retainer against the piston spring and rotate clockwise to engage the retainer catch. Finally, replace the liquid end on the drive module. Attach a disposable tip, and test for proper sealing as described above.

2500 MICROLITER LIQUID END:
The piston assembly is threaded into the shaft. Use the seal wrench (Cat. No. 6100-231) to remove and replace the assembly as in Figure 16.3. Reinsertion is most easily done with the shaft inverted. After tightening with the wrench, push the piston and release to test for free movement. If the piston does not return freely, the O-ring and seal are not properly seated.

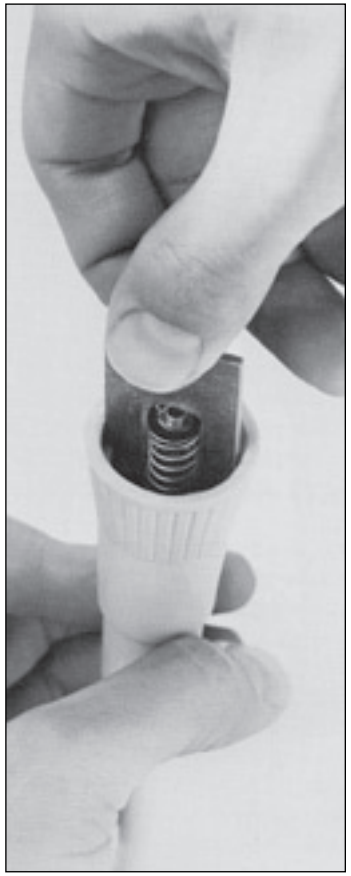


FIGURE 16.3
2500 µL LIQUID END
WITH SEAL WRENCH

17. TROUBLESHOOTING

The EDP Electronic Pipette is very self-protective. There is actually very little that can go wrong, assuming proper pipetting techniques are followed and proper care and maintenance procedures, described earlier in this manual, are exercised.

The EDP pipette will not accept volume settings that are outside the allowable range for each liquid end. However, it is the responsibility of the user to ensure that the proper liquid end encoder plug is inserted in the control module.

If the Power Pack does not carry sufficient charge for accurate pipetting, the audible tone will warble and the word "Lob" will appear on the display. If the Power Pack is completely discharged, the instrument will not operate or emit any sound. Recharge the Power Pack (See Section 11) before seeking service assistance.

If anything confusing happens during operation of the EDP pipette, this can virtually always be corrected by clearing the pipette. To clear the pipette, press the key sequence F O. The piston will return to the home position and the keyboard will be enabled. The one instance where this will not work is covered in Section 10, Question #8.

One more general remedy for confusing problems is to remove power or remove the encoder plug from the drive module briefly and then replace it. (Be sure the keyboard is unlocked if you remove the encoder.) This will cause the EDP pipette to reset and go through the normal 8-second initialization routine. At the end of this routine the instrument will be in the **PIPETTE** mode and the volume setting will be the nominal full-scale volume. The instrument should now function normally. Note that this procedure should be applied only as a last resort. It has the disadvantage that any existing volume specifications will be lost from the microcomputer memory and must be re-entered.

EDP pipettes are constructed from the highest quality mechanical and electrical components and designed for trouble-free operation. However, in the event that a real electromechanical malfunction should occur, Rainin Instrument LLC maintains a complete service department to correct the problem. Please call RAININ for instructions regarding service for your EDP instrument.

18. PERFORMANCE SPECIFICATIONS

Performance specifications for EDP Electronic Pipettes are of two types:

ACCURACY means the closeness with which the dispensed volume approximates the volume setting of the instrument. Accuracy is specified as "Mean Error," the maximum amount by which the mean value of a large number of replicate measurements of the same volume will deviate from the set volume. The specification applies to water in the ambient temperature range of 18°C to 25°C.

PRECISION refers to the "scatter" of individual measurements around the mean of a series of measurements. It is expressed as standard deviation.

Specifications for precision are always tighter than for accuracy. In most experiments, where sample measurements are compared to standards, it is the specification for precision that will determine the accuracy of results as long as both samples and standards are measured with the same instrument.

EDP Specifications:

Model	Maximum Volume (µL)	Accuracy*		Precision*	
		%	µL (±)	%	µL (≤)
EDP-10	10	1	0.1	0.5	0.04
EDP-25	25	1	0.1	0.3	0.05
EDP-100	100	0.8	0.3	0.2	0.1
EDP-250	250	0.8	0.5	0.15	0.15
EDP-1000	1000	0.8	3	0.13	0.6
EDP-2500	2500	0.8	8	0.12	2

***NOTE:**
To determine specification, multiply volume setting by the percent figure. Compare to the microliter figure. The specified limit is the larger value.

19. ORDERING INFORMATION

All EDP Electronic Pipettes, parts, and subassemblies may be ordered from Rainin Instrument, LLC:

By phone 8am–8pm EST: **800-4-RAININ** (800-472-4646)

By fax: **510-564-1617** or **781-938-1152**

7500 Edgewater Drive
Oakland, CA 94621

Rainin Road
Woburn, MA 01801

Order online: **www.rainin.com**

The following catalog numbers are discontinued, replaced by EDP-Plus models:

OLD CAT. NO.	NEW CAT. NO.	DESCRIPTION
		Complete Pipettes:
EDP-10	EP-10	Electronic Pipette, 10 µL, with Wall Transformer
EDP-25	EP-25	Electronic Pipette, 25 µL, with Wall Transformer
EDP-100	EP-100	Electronic Pipette, 100 µL, with Wall Transformer
EDP-250	EP-250	Electronic Pipette, 250 µL, with Wall Transformer
EDP-1000	EP-1000	Electronic Pipette, 1000 µL, with Wall Transformer
EDP-2500	EP-2500	Electronic Pipette, 2500 µL, with Wall Transformer
		EP-10ML Electronic Pipette, 10 mL, with Wall Transformer
		Accessories:
6100-080	same	Portable Power Pack
6101-049	same	EDP Rapid Charge Stand, 105–130V, 50–60Hz, US
6101-048	same	EDP Rapid Charge Stand, 210–260V, 50–60Hz, UK
6101-047	same	EDP Rapid Charge Stand, 210–260V, 50–60Hz, Euro

Continued…

OLD CAT. NO.	NEW CAT. NO.	DESCRIPTION
		Liquid Ends:
6100-065	6100-461	Liquid End, 10 µL
6100-066	same	Liquid End, 25 µL
6100-067	same	Liquid End, 100 µL
6100-068	same	Liquid End, 250 µL
6100-069	same	Liquid End, 1000 µL
6100-030	same	Liquid End, 2500 µL
	6100-032	Liquid End, 10 mL
		Replacement Control module:
6100-081	6100-462	Control module, for all volumes
		Replacement Parts:
6100-063		Wall Transformer, 105–130V, 50–60Hz, US
6100-064 UX		Wall Transformer, 210–260V, 50–60Hz, UK
6100-044 EX		Wall Transformer, 210–260V, 50–60Hz, Euro

20. WARRANTY

All EDP Electronic Pipettes are warranted for one year against defects in materials and workmanship. For warranty information regarding the warranty or repair of any EDP instrument, please call Rainin Instrument, LLC at 800-472-4646.

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7500 Edgewater Drive, Box 2160
Oakland, CA 94621-0060

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