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The MICROLAB® 500 Series:

MICROLAB 501A, MICROLAB 503A, and MICROLAB 504A

User's Manual

HAMILTON

THE MEASURE OF EXCELLENCE℠

Part Number 69175 (Rev. E)

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Hamilton Company Instrument Warranty

Hamilton Company warrants this equipment (except valves*) to be free of defects in material and workmanship for 12 months from the date of receipt. This warranty is extended to the buyer of record on the original purchase order to Hamilton Company. Hamilton Company or an authorized Hamilton representative agrees to repair or replace, at its option and free of charge to the buyer at a normal place of business or at a Hamilton repair facility, any part or parts that under proper and normal use prove to be defective during the warranty period.** Abuse, unauthorized replacement of parts, modifications, or adjustments made by other than Company or its assigned representatives voids this warranty.

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*All Hamilton Company valves are warranted to be free of defects in material and workmanship at the time of delivery.

**Hamilton Company reserves the right to refuse to accept the return of any instrument or valve that has been used with radioactive or microbiological substances, or any other material that may be deemed hazardous to employees of Hamilton Company.

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Instruction to the User

This equipment has been tested and found to comply with the limits for a class B digital device, pursuant to part 15 of the FCC Rules. These limits are designed to provide reasonable protection against harmful interference in an installation. This equipment generates, uses, and can radiate radio frequency energy, and if not installed and used in accordance with the instructions, may cause harmful interference to radio communications. However, there is no guarantee that interference will not occur in a particular installation. If this equipment does cause harmful interference to radio or television reception, which can be determined by turning the equipment off and on, the user is encouraged to try to correct the interference by one or more of the following measures:

- Reorient or relocate the receiving antenna.
- Increase the separation between the equipment and receiver.
- Connect the equipment into an outlet on a circuit different from that to which the receiver is connected.
- Consult the dealer or an experienced radio/TV technician for help.

This equipment has been verified to comply with the limits for a class B computing device, pursuant to FCC Rules. In order to maintain compliance with the FCC regulations, shielded cables must be used with this equipment . Operation with non-approved equipment or unshielded cables is likely to result in interference to radio and TV reception. The user is cautioned that changes and modifications made to the equipment without the approval of the manufacturer could void the user's authority to operate this equipment.

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Preface Welcome to the World of Hamilton Precision Instruments

Congratulations on your purchase of a Hamilton MICROLAB 500 system. The Hamilton MICROLAB 500 is a versatile, semi-automatic, precision liquid processor. Various models of the MICROLAB 500 function as either single- or dual-syringe diluter/dispensers.

The MICROLAB 500 functions on the principal of liquid/liquid displacement. At the heart of each MICROLAB 500 system is a highly efficient, precision stepper motor drive that is combined with world-famous Hamilton GASTIGHT syringes. The result is a precise and accurate instrument that is very easy to set up and use.

With proper care and maintenance, your new MICROLAB 500 system will serve you faithfully. To learn about the proper care and maintenance of your investment, please take the time to read this manual. Also, please read the warranty information that appears on the copyright page in this manual and on the separate warranty sheet that is included in your MICROLAB 500 shipping kit.

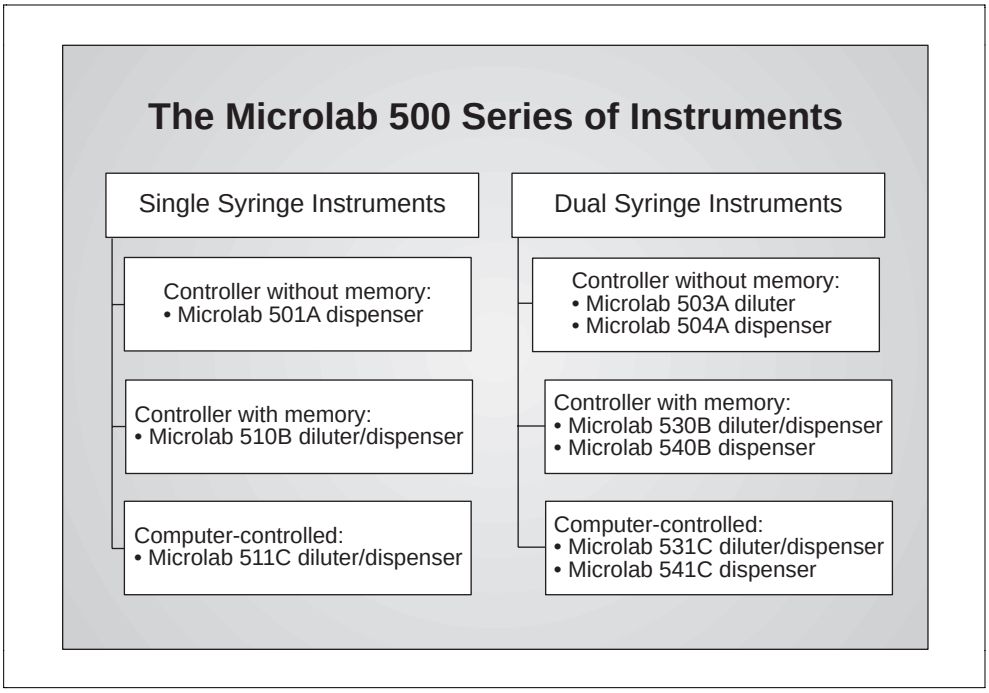
The Hamilton Company thanks you for purchasing this Hamilton product. Welcome to the world of Hamilton precision instruments!

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About the MICROLAB 500 Series of Instruments

All of the MICROLAB 500 systems feature four common pipette modes: fill, dispense, auto-refill, and prime. The systems are capable of performing accurate and precise transfer pipetting, and of performing automated dilutions up to 1:25,000. The instruments can also dispense up to 50 mL per cycle. Figure PR–1 provides an overview of the MICROLAB 500 Series of Instruments.

Figure PR–1 The MICROLAB 500 Series of Instruments



The MICROLAB 500 Series of instruments consists of three different lines of diluter / dispensers.

- **Controller without memory:** Use the controller unit to manually enter methods. This controller unit does not have memory, so methods cannot be stored.

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- **Controller with memory:** This controller unit has memory, allowing you to program and store your own custom methods. Or, use the controller unit to run manual methods.
- **Computer controlled:** No controller unit is included; use a computer to operate the instrument.

The MICROLAB 501A, 503A, and 504A are described in this manual.

- The **MICROLAB 501A** is a single syringe dispenser designed for single precision dispensing applications.
- The **MICROLAB 503A** is a dual syringe diluter designed for repetitive dilution applications.
- The **MICROLAB 504A** is a dual syringe dispenser designed for precision dispensing applications that require more than one liquid to be dispensed at a time.

Upgrading Your MICROLAB 500 System

Both the MICROLAB 501A and 503A systems can be upgraded to MICROLAB 504A systems. For upgrade information or for information about purchasing any of the MICROLAB 500 models, contact your authorized Hamilton sales representative or contact Hamilton Company.

In the United States:
Hamilton Company, P.O. Box 10030, Reno, Nevada 89520–0012
Telephone Numbers (in the USA and Canada):
Technical / Customer Service +1–800–648–5950 8 a.m. to 5 p.m. PST
Instrument Service +1–800–527–5269

Outside the USA and Canada:
+1–775–858–3000
Fax Number: +1–775–856–7259

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In Switzerland:

Hamilton Bonaduz AG, Ch–7402, P.O. Box 26,
Bonaduz, Switzerland
Telephone Number: +41–81–660–60–60
Fax Number: +41–81–660–60–70

About This Manual

This manual provides technical information about the MICROLAB 501A, 503A, and 504A, and is divided into chapters that cover the following topics:

- Chapter 1, Getting Started, provides an overview of the MICROLAB 500 system, including a complete parts list and a brief description of the system components.
- Chapter 2, Installing the MICROLAB 500, describes how to set up the system.
- Chapter 3, Using the MICROLAB 500, provides step-by-step instructions for using the system. It also provides sample applications.
- Chapter 4, Caring for the MICROLAB 500, describes everyday maintenance techniques.
- Chapter 5, Troubleshooting, contains tables that list system messages and their meanings, and common problems and their solutions.
- The Appendixes provide detailed information, such as technical specifications, ordering information, etc.
- The Glossary defines terms used in this manual.
- The Index provides a quick-reference to the topics described in this manual.

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Conventions Used in This Manual

Throughout this manual symbols are used to call your attention to various kinds of information.

⚠ **Warning! Information that is essential for avoiding personal injury is flagged with the International Warning Symbol and appears like this in the text.** ⚠

▲ **Important Information that is essential for avoiding damage to equipment appears like this in the text.** ▲

✶ **Note: Interesting information or information that can help improve system performance appears like this in the text.** ✶

System messages or prompts that appear in the message display windows are shown in `courier` font.

A Word About Single Syringe Instruments

Throughout this manual you will see references to multiple syringes, volumes, speeds, and to the right-side controls. If you are using a MICROLAB 501A single syringe dispenser, please disregard these references. The right-side controls are not functional on single syringe instruments. The right display window, however, is active.

Any operational differences between the single and the dual syringe instruments are called out in the text.

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Chapter 1 Getting Started

This chapter provides a brief overview of the MICROLAB 500 system. Information in this chapter includes:

- MICROLAB 500 parts lists
- MICROLAB 500 components
  - the drive unit
  - the controller unit
  - hand pipettors / probes

All MICROLAB 500 instruments come with everything you need to start using the system, with the exception of syringes. You must separately purchase syringes for use with the MICROLAB 500 systems. For complete lists of syringes, accessories, and replacement parts for the MICROLAB 500, see Appendix C, Ordering Parts and Accessories for the MICROLAB 500.

✶ **Note: Contact your local delivery company if you notice any visual damage to the MICROLAB 500 shipping package or to its contents. Also, you may want to save the shipping container in case you ever need to return the instrument for service.** ✶

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MICROLAB 500 Parts Lists

This section includes complete parts lists for the MICROLAB 501A, 503A, and 504A systems. After you unpack your MICROLAB 500, check to see that you have received all parts before attempting to set up the system. The parts lists are presented in four separate tables with four corresponding figures.

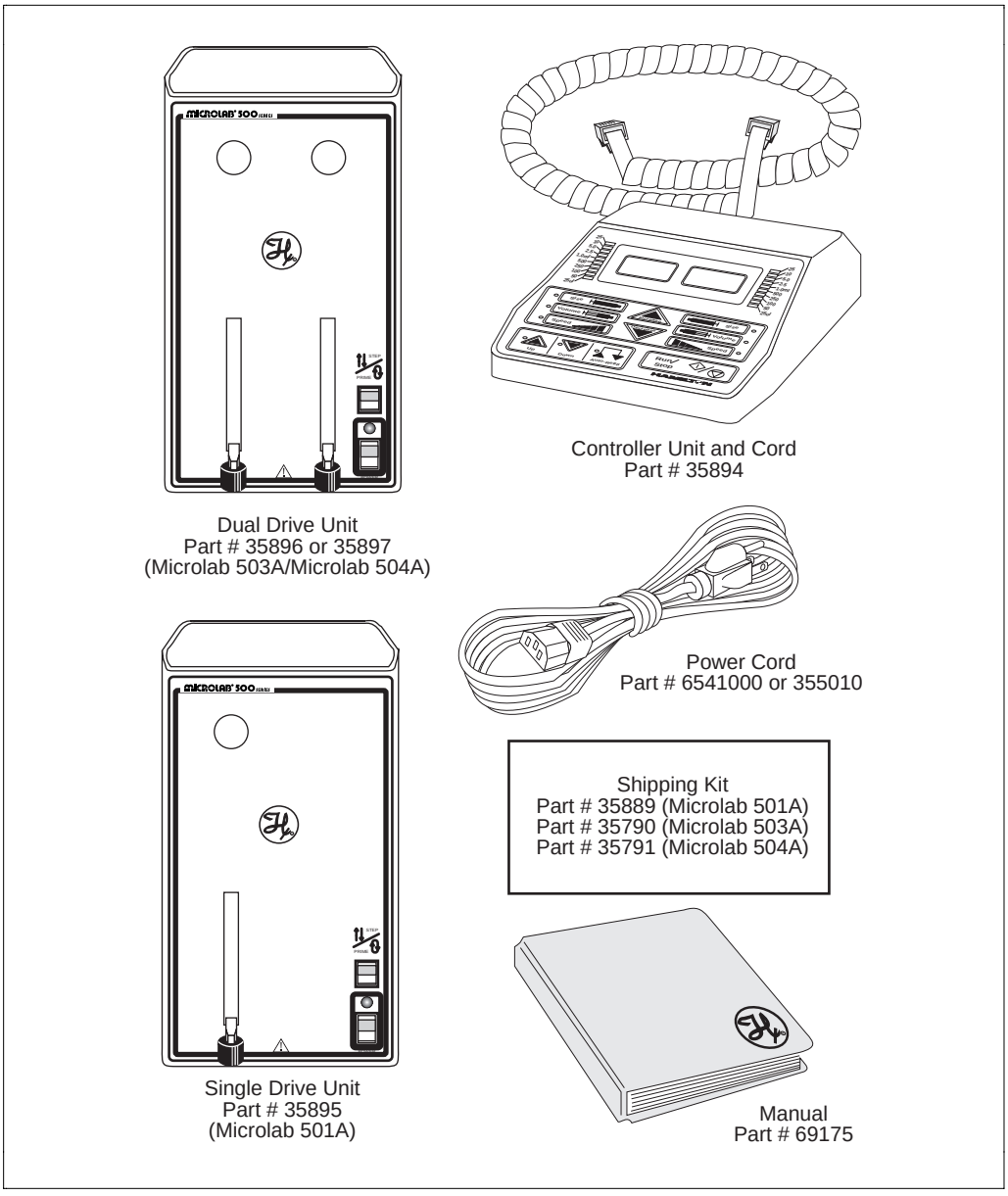
Table 1–1 lists the non-programmable models in the MICROLAB 500 series, their components, and each component's part number. Figure 1–1 shows these components.

Table 1–1 MICROLAB 500 System Descriptions

Model	Part #	Drive Unit Part #	Controller Unit & Cord Part #	Manual Part #	Power Cord	Shipping Kit Part #
MICROLAB 501A 115V	ML501115	35895	35894	69175 (English) 69181 (French) 69179 (German) 69185 (Portuguese) 69187 (Spanish)	6541000	35889
MICROLAB 501A 220V	ML501220	35895	35894	same as above	355010	35889
MICROLAB 503A 115V	ML503115	35896	35894	same as above	6541000	35790
MICROLAB 503A 220V	ML503220	35896	35894	same as above	355010	35790
MICROLAB 504A 115V	ML504115	35897	35894	same as above	6541000	35791
MICROLAB 504A 220V	ML504220	35897	35894	same as above	355010	35791

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Figure 1–1 MICROLAB 500A System Components (items shown are not to scale)



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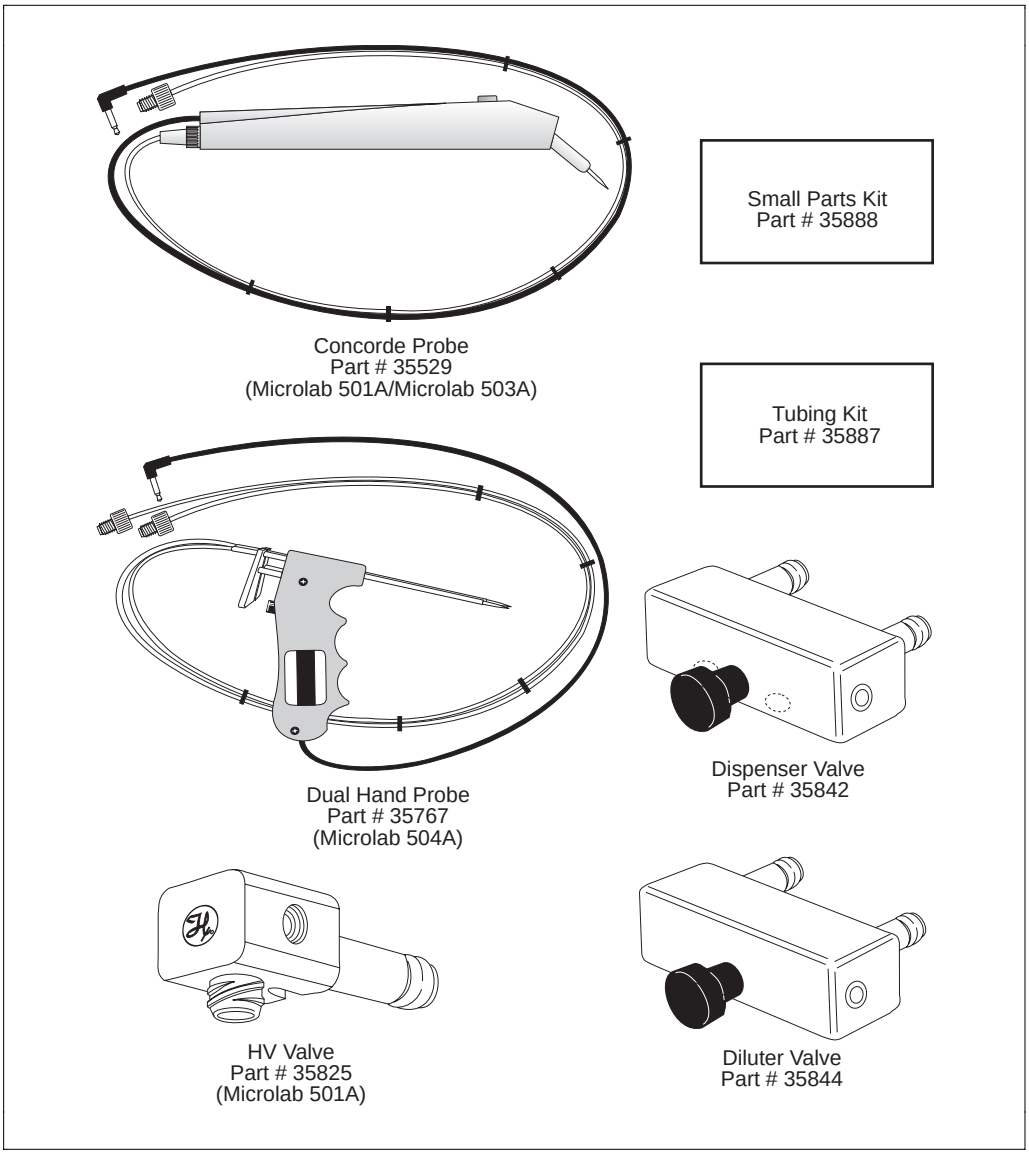
Table 1–2 lists the components that make up the MICROLAB 500 Shipping Kit (shown as a box in Figure 1–1). Figure 1–2 shows these components.

Table 1–2 MICROLAB 500 Shipping Kit

Shipping Kit Part #	Valve Part #	Hand Probe Part #	Small Parts Kit Part #	Tubing Kit Part #
MICROLAB 501A 35889	HV Valve 35825	Concorde Probe 35529	35888	35887
MICROLAB 503A 35790	Diluter Valve 35844	Concorde Probe 35529	35888	35887
MICROLAB 504A 35791	Dispenser Valve 35842	Dual Hand Probe 35767	35888	35887 **2 items**

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Figure 1–2 MICROLAB 500 Shipping Kit Components (items shown are not to scale)



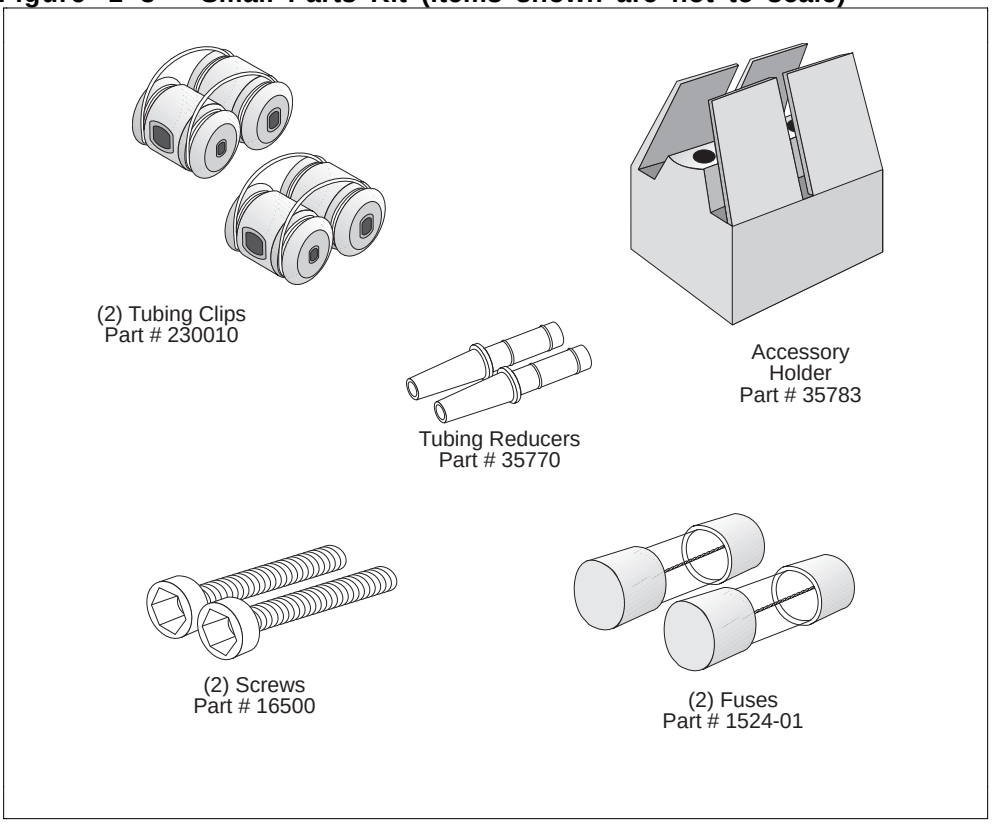
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Table 1–3 lists the components that make up the MICROLAB 500 Small Parts Kit (shown as a box in Figure 1–2). Figure 1–3 shows these components.

Table 1–3 Small Parts Kit #35888 (For All Models)

Tubing Clips Part #	1 AMP Fuses Part #	Accessory Holder Part #	Screws Part #	Tubing Reducers Part #
230010 **2 items**	1524-01 **2 items**	35783 **1 item**	16500 **2 items**	35770 **2 items**

Figure 1–3 Small Parts Kit (items shown are not to scale)



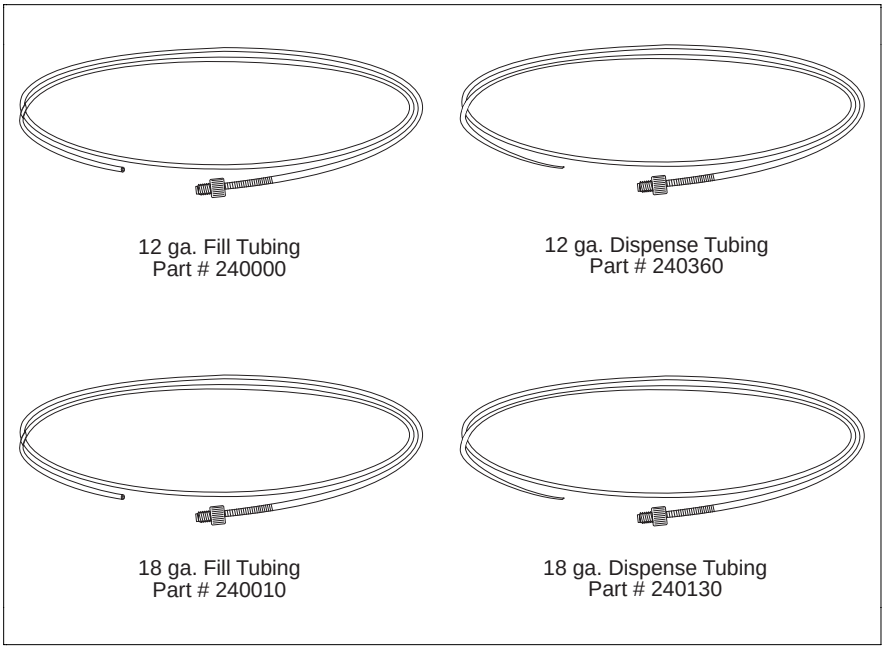
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Table 1–4 lists the components that make up the MICROLAB 500 Tubing Kit (shown as a box in Figure 1–2). Figure 1–4 shows these components.

Table 1–4 Tubing Kit #35887 (For All Models)

12 ga. x 650 mm Fill Tubing (not tapered) Part #	18 ga. x 650 mm Fill Tubing (not tapered) Part #	12 ga. x 900 mm Dispense Tubing (tapered) Part #	18 ga. x 900 mm Dispense Tubing (tapered) Part #
240000*	240010*	240360*	240130*

Figure 1–4 Tubing Kit (items shown are not to scale)



* M6 threaded hubs are used on all tubing.

For complete lists of syringes, accessories, and replacement parts for the MICROLAB 500, see Appendix C, Ordering Parts and Accessories for the MICROLAB 500.

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A Brief Introduction to the MICROLAB 500A

The MICROLAB 501A, 503A, and 504A systems each consist of three basic units. These units include:

- a drive unit
- a controller unit
- a hand probe

This section briefly describes these units and the individual components that comprise each unit. See Chapter 2, Installing the MICROLAB 500, for complete installation instructions; see Chapter 3, Using the MICROLAB 500, for complete usage instructions.

Drive Unit

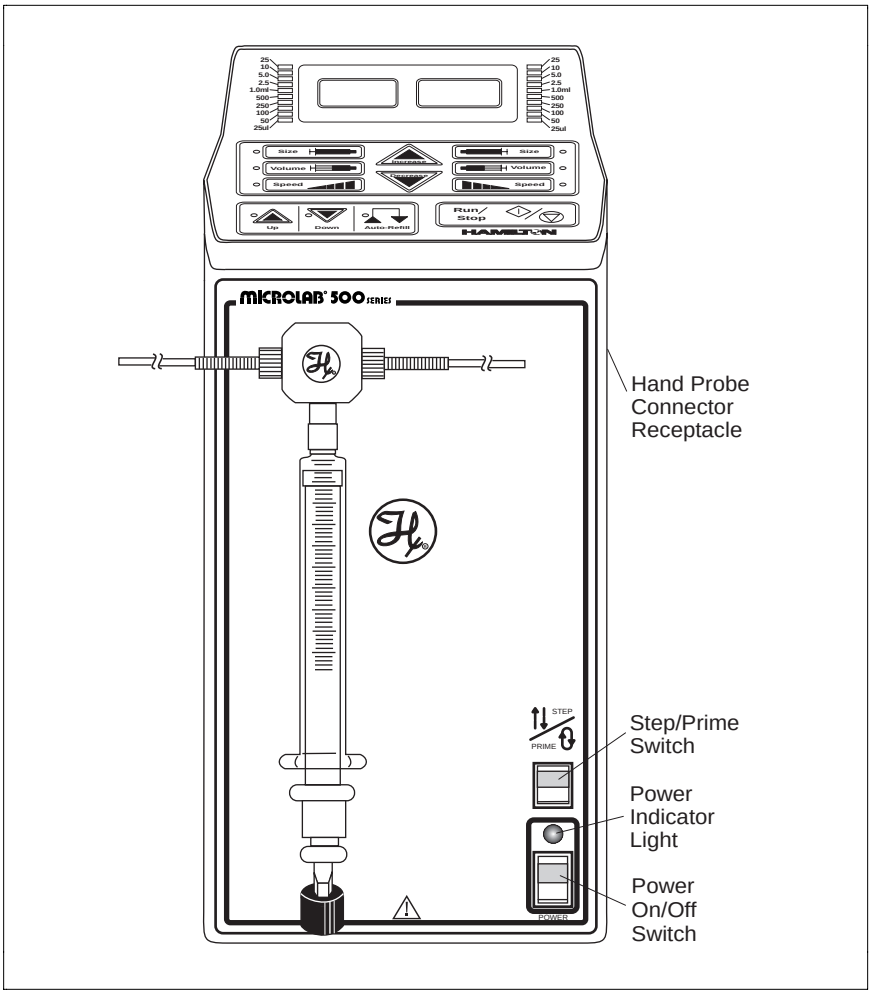
The drive unit is the heart of each MICROLAB 500 system. The drive unit contains a precision drive motor, the syringe drive arms, the valve assembly, and the power switches and connector receptacles. These features allow you to control other sub-assemblies, and together they create a very versatile and functional instrument.

Figure 1– 5 shows the front view of the MICROLAB 501A single syringe dispenser. In this figure, the controller unit rests on top of the drive unit and a syringe is attached to the syringe drive arm.

⚠ **Warning! This warning label appears on the front panel of the ML500. It indicates that a pinch hazard exists when the syringe drive is moving.** ⚠

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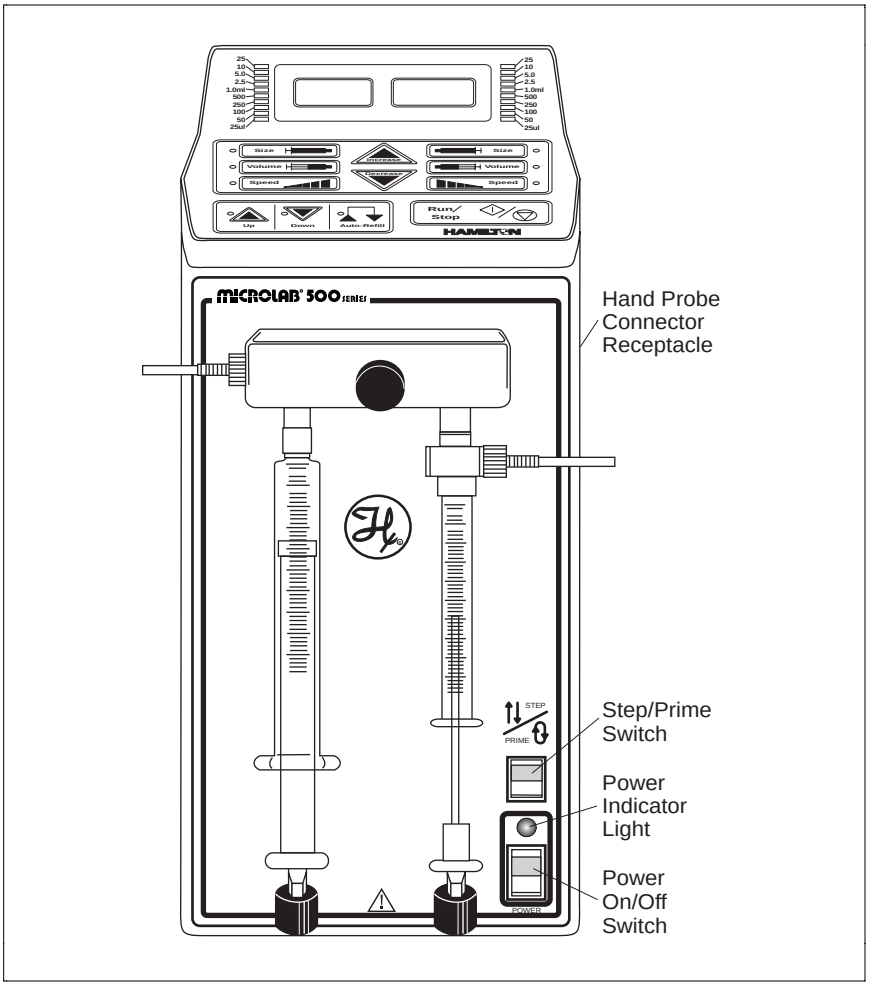
Figure 1–5 Front View of the MICROLAB 501A Single Syringe Dispenser



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Figure 1–6 shows the front view of the MICROLAB 503A dual syringe diluter. In this figure, the controller unit rests on top of the drive unit and syringes are attached to the syringe drive arms.

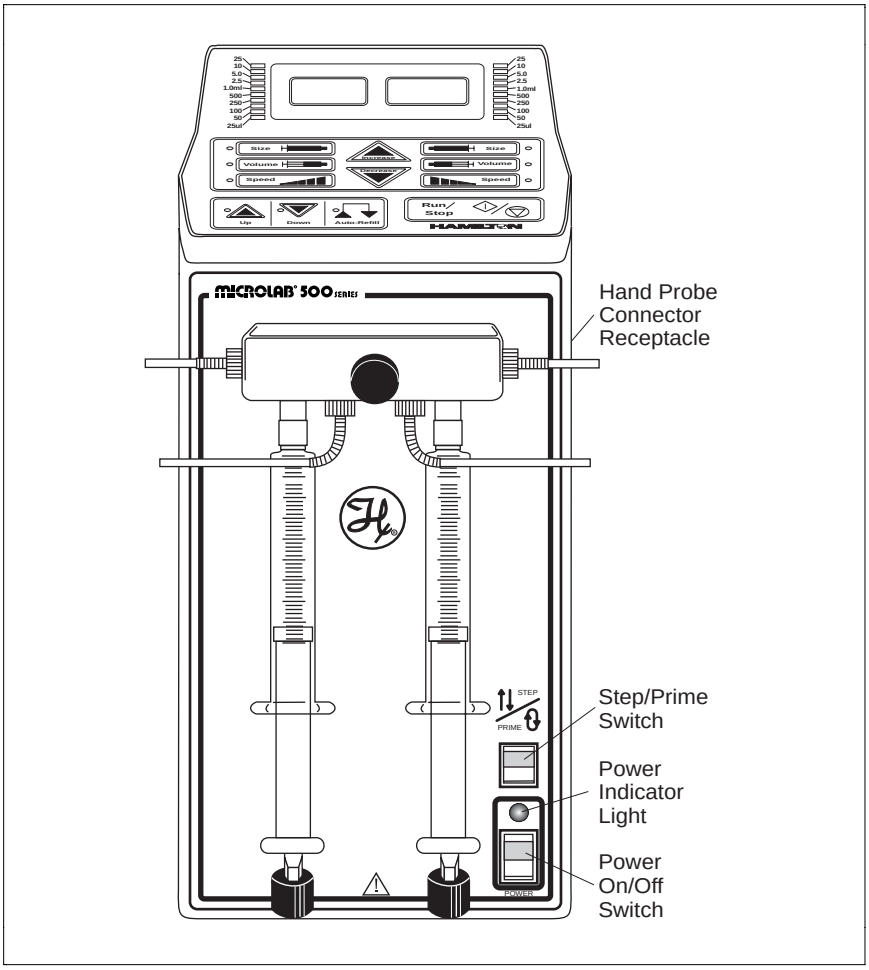
Figure 1–6 Front View of the MICROLAB 503A Dual Syringe Diluter



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Figure 1–7 shows the front view of the MICROLAB 504A dual syringe dispenser. In this figure, the controller unit rests on top of the drive unit and syringes are attached to the syringe drive arms.

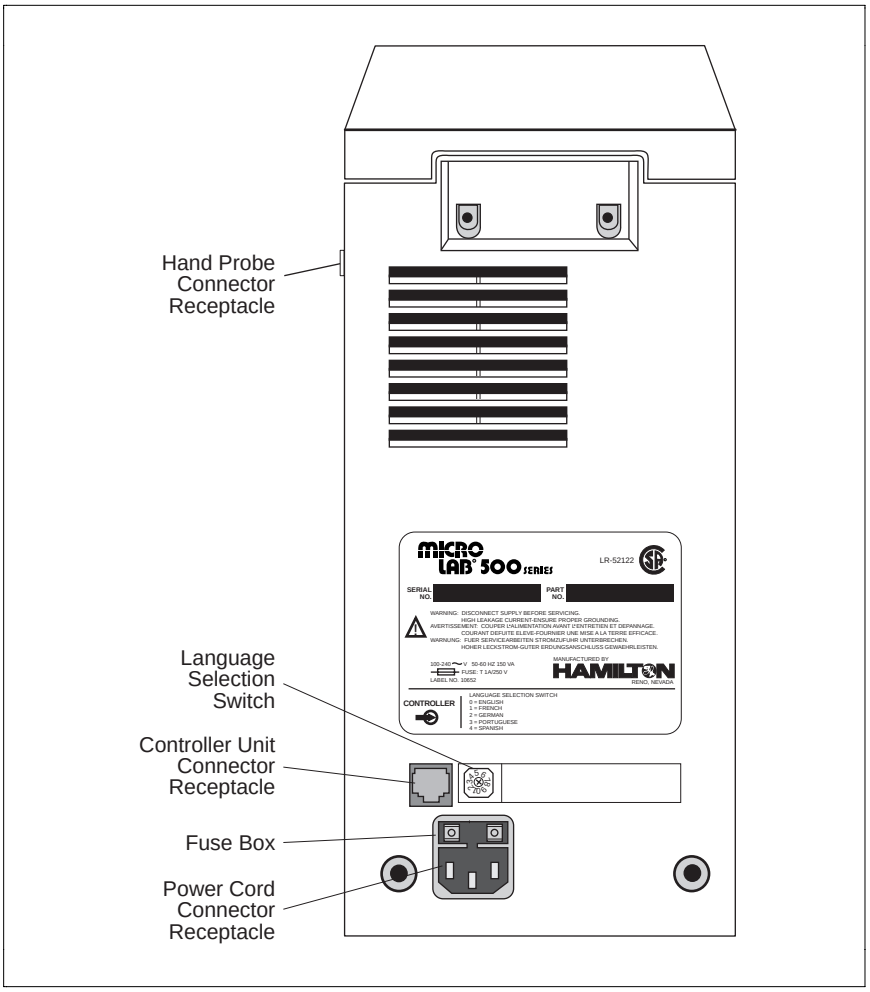
Figure 1–7 Front View of the MICROLAB 504A Dual Syringe Dispenser



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Figure 1–8 shows the rear view of all units.

Figure 1–8 Rear View of the MICROLAB 501A, 503A, and 504A



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Power Cord Connector Receptacle

The power cord connector receptacle is located on the back of the drive unit; the power cord fits into this receptacle only one way. The receptacle accepts cords for either 115V or 220V without any adaptation of the drive unit. See Figure 1–4 for the location of the power cord connector receptacle.

Hand Probe or Footswitch Connector Receptacle

The hand probe connector receptacle is located on the upper right side of the drive unit. You can insert either a hand probe jack or a footswitch jack into this receptacle. See Figures 1–1 through 1–3 for the location of the hand probe connector receptacle.

Fuse Box

The fuse box is located at the top of the power cord connector receptacle. To gain access to the fuse box, you must first remove the power cord. See Figure 1–4 for the location of the fuse box.

Language Selection Switch

The Language Selection switch is located on the back of the drive unit below the serial number label. See Figure 1–4 for the location of this switch.

Use the Language Selection switch to choose the language that message codes will appear in. (Messages codes provide you with system status and appear in the message display windows, located on the controller unit.) You can select from five different languages, including English, French, German, Portuguese, and Spanish.

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Controller Unit Connector Receptacle

The controller unit connector receptacle is located on the back of the drive unit just below the serial number plate. Insert the controller unit cable connector into this receptacle; the cable fits only one way. See Figure 1–4 for the location of the controller unit connector receptacle.

Power On/Off Switch and Power Indicator Light

The Power On / Off switch and the Power Indicator light are located on the front of the drive unit in the lower right-hand corner. See Figures 1–1 through 1–3 for the locations of the switch and the indicator light.

The Power On / Off switch is a two-position rocker switch.

- To power-on the MICROLAB 500, press the upper half of the switch. The system beeps twice when it is powered on.
- To power-off the MICROLAB 500, press the lower half of the switch.

The Power Indicator light is a small green LED located directly above the Power On / Off switch. It is lit when the unit is powered on.

Step/Prime Switch



The Step / Prime switch is located on the front of the drive unit in the lower right-hand corner, directly above the power indicator light. See Figures 1–1 through 1–3.

The Step / Prime switch is a three-position rocker switch.

- When the Step / Prime switch is in the middle position, the ML500 is inactive.

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- When you press the lower part of the Step / Prime switch , the ML500 goes into prime mode. When in prime mode, the syringe drive arms automatically move up and down, opening the valve ports, and moving fluid through the system. The ML500 stays in prime mode until you press the upper or the middle part of the Step / Prime switch.



- When you press the upper part of the Step / Prime switch , the ML500 goes into Step mode. When in Step mode, the drive arms move only as long as you depress the Step / Prime switch. When you release the switch, movement stops.

Use the Step mode to move the syringe drive arm down and away from the home position before installing or removing syringes.

✶ **Note: Use the Step mode to return the syringes back to the Home position. This good habit ensures that the syringes will be in the correct position for your next command.** ✶

Valve Assembly

The valve assembly controls the flow of liquid through the fluid path. The 501A, 503A, and 504A models each use a different valve assembly; you must attach the assembly to the drive unit. See Figures 1–1 through 1–3 for the location of the valve assembly. See “Installing the Valve Assembly” in Chapter 2 for installation instructions.

Syringe Drive Arms

You attach syringes to the MICROLAB’s syringe drive arms. The syringe drive arms are engineered to drive Hamilton precision syringes with high-resolution stepper motors; the motors and drive arms are connected by a precision lead screw. See “Selecting, Installing, and Removing Syringes” in Chapter 2 for syringe installation instructions.

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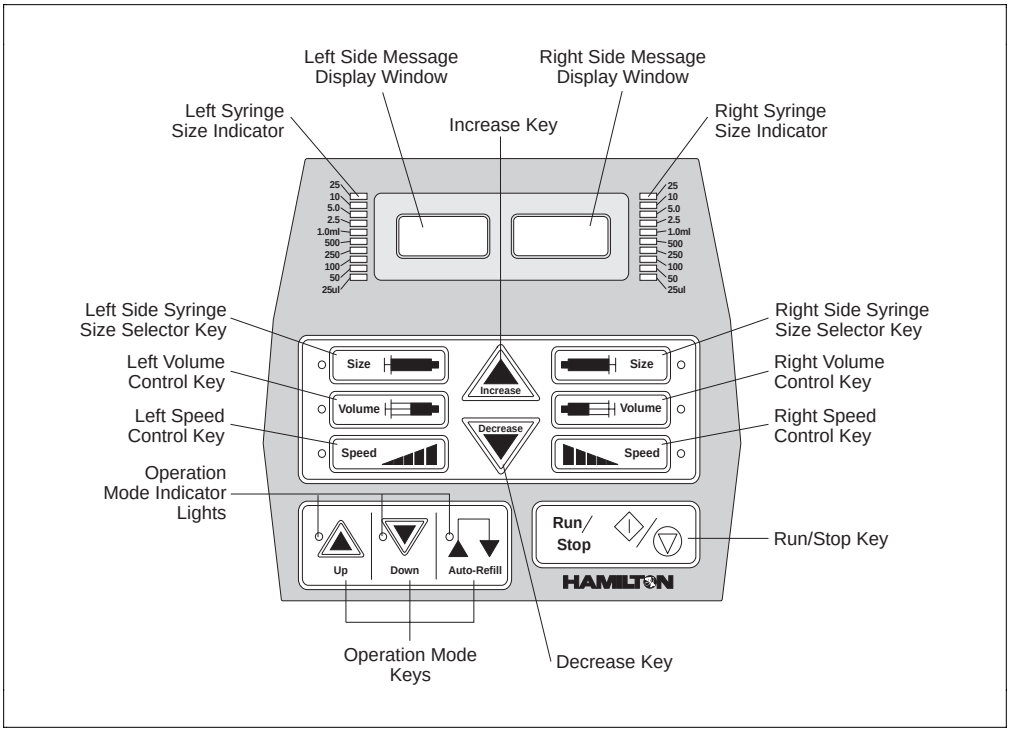
The Controller Unit

The controller unit is a portable device that connects to the syringe drive unit via the controller connector cord. The controller unit sends display information and instructions to the drive unit. Figure 1–9 shows the controller unit.

Two message display windows are located at the top of the unit and three main groups of controls are located across the center and the bottom of the unit. The controls are divided into three functional groups:

- function control keys
- operation keys
- Run / Stop key

Figure 1–9 The Controller Unit



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For ease of use and for everyday storage, the controller unit is designed to fit on top of the drive unit.

Message Display Windows

The message display windows, located at the top of the controller unit, show the status of the instrument and provide information about current control settings:

- the size of the left or the left and right syringes
- the selected volume for the left or the left and right syringes
- the drive speed for the left or the left and right syringes
- the volumes being pipetted, when the MICROLAB is in operation
- all system information or error messages

See Figure 1–9 for the location of the display windows.

Function Control Keys

The keys by which you send information to the drive unit are marked with images, or icons, that represent each key's function. Use the keys to enter information about the syringes, volumes, speeds, and operations.

Increase and Decrease Keys



Increase

To increase syringe size, pipetting volume, or syringe drive speed, press the Increase key.



Decrease

To decrease syringe size, pipetting volume, or syringe drive speed, press the Decrease key.

After you select a specific function key and then press the Increase or Decrease key, the new size, volume, or speed displays in the message display windows.

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Syringe Size Keys

The Syringe Size keys allow you to select either or both (on a two-syringe instrument) the left or the right syringe. Once a syringe is selected, you can adjust its size, volume, or speed. You can select either the left or the right syringe in any order; the system defaults to the left syringe. You must select a syringe size before you can change its volume or speed.



Press the left Syringe Size key to select the left syringe. Then press the Increase or the Decrease key to change its size.



Press the right Syringe Size key to select the right syringe. Then press the Increase or the Decrease key to change its size.

When you select either the left or the right Syringe Size key, a green LED indicates which of the keys is active. As you change the size of a syringe, notice that the syringe size indicator lights, located on either side of the message display windows, move to reflect the size of the syringe.

✶ **Note: The syringe size indicators show syringe sizes over 500 µL in milliliters, but the message display windows show the syringe size in microliters.** ✶

Volume Keys

To set the volumes you wish to pipette, press either the left or the right Volume key and then press the Increase or the Decrease key.

✶ **Note: You must enter a syringe size before you can change its volume.** ✶

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Press the left Volume key to select the left syringe. Then press the Increase or the Decrease key to change the volume to be pipetted by the left syringe.



Press the right Volume key to select the left syringe. Then press the Increase or the Decrease key to change the volume to be pipetted by the right syringe.

When you select either the left or the right Volume key, a green LED indicates which of the keys is active.

✶ **Note: The message display windows show the volume settings in microliters.** ✶

Speed Keys

To set the speed of a syringe drive arm, press either the left or the right Speed key; then press the Increase or the Decrease key. You must enter a syringe size before you can change its speed.



Press the left Speed key to select the left syringe. Then press the Increase or the Decrease key to change the speed of the left syringe drive arm.



Press the right Speed key to select the right syringe. Then press the Increase or the Decrease key to change the speed of the right syringe drive arm.

When you select either the left or the right Speed key, a green LED indicates which of the keys is active.

✶ **Note: Drive arm speeds represent the number of seconds needed to drive a syringe full stroke (6 cm). Therefore, the smaller the speed number the faster the speed. The fastest speed is two seconds, while the slowest speed is 20 seconds.** ✶

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Operation Keys

The operation keys are located in the lower left corner of the controller unit. When you select an operation, a green LED next to the operation key lights up. To start an operation, press the Run / Stop key or press the probe button. When an operation starts, the system beeps once.



The Down operation moves the syringe drive arms down from the Home position, pulling a specified volume of liquid into the syringes.

- In the MICROLAB 501A dispenser or the MICROLAB 503A diluter / dispenser, liquid is pulled in from the left side inlet valve port.
- In the MICROLAB 504A dispensers, liquid is pulled in from both the left and right outside ports.

When the Down stroke is complete (this could be at any location within the drive arm's range of movement, depending on your specific application), the operation automatically switches to Up. The LED automatically indicates that the Up operation is active.



The Up operation moves the syringe drive arms up, forcing a specified volume of liquid out of the syringes and through the dispense tubing.

When the Up stroke is complete, and the syringe drive arms (both arms, if using a dual syringe instrument) return to the Home position, the operation automatically switches to the Down operation. The LED automatically indicates that the Down operation is active. If both arms do not return to the Home position, the Up operation remains active.



The Auto-Refill operation moves the drive arms down to automatically refill the syringes after liquid is dispensed. When in the Auto-Refill operation, unlike the Up or the Down operations, the syringe drive arms complete an entire cycle, not just a stroke.

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- Selecting the Auto-Refill operation when the drive arm is in the Home position moves the drive arm to the Down position.
- Selecting the Auto-Refill operation when the drive arm is already in the Down position moves the drive arm one full cycle: from the Down position, up to Home, and down once again.

The Auto-Refill operation is useful for dispense functions, since it automatically refills syringes for the next dispense. Therefore, you can complete a fill and dispense function with one command. The Auto-Refill operation is also useful for doing serial dilutions.

Run/Stop Key



The Run/Stop key is located in the bottom right corner of the controller unit. The first time you press this key after the system is powered on and the syringe sizes are selected, the system will initialize itself. Until the system initializes itself, Up is the only active operation (to move the drive arms to the Home position.)

After initialization, use the Run/Stop key to start an operation. Choose an operation (Up, Down, or Auto-Refill), then press Run/Stop to start.

- If Up, Down, or Auto-Refill is selected, you can pause in the middle of a stroke by pressing the Run/Stop key once. Resume an operation at the same place in the stroke by pressing the Run/Stop key again.
- If the Step/Prime switch (on the drive unit) is in use and is in the Prime mode, you cannot use the Run/Stop key to pause in the middle of a stroke or a cycle. Instead, the drive arms continue until they reach the Home position before they stop.

The Run/Stop key generates a command signal that activates the next step of an operation. You can generate this same command signal by pressing the button on a hand probe or by using a footswitch.

See Chapter 3, Using the MICROLAB 500, for complete instructions about using the function keys.

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Pipettors/Probes

Each MICROLAB 500 system comes with a remote push-button, hand-held pipettor / probe. The standard accessory probes include:

- the Concorde Push-button Hand Pipettor / Probe (ships with the MICROLAB 501A and the MICROLAB 503A)
- the Dual Push-button Hand Pipettor / Probe (ships with the MICROLAB 504A)

Additionally, three other optional probes may be ordered separately for use with any MICROLAB 500 system. These probes include:

- the Disposable Tip Push-button Hand Pipettor / Probe
- the Luer Lock Tip Push-button Pipette Hand Pipettor / Probe
- the Viscous Sample Push-button Hand Pipettor / Probe

Concorde Push-button Hand Pipettor/Probe

The Concorde Push-button Hand Pipettor / Probe is a single-dispense pipette probe that features a slim, comfortable design. Use this probe with MICROLAB 501 and 503 systems. The Concorde probe attaches directly to a sampling syringe or to the valve assembly. This probe accommodates both 12- or 18-gauge tubing and features adjustable extension lengths beyond the probe tip. See Figure 1–10.

Dual Push-button Hand Pipettor/Probe

The Dual Push-button Hand Pipette Probe is a dual-dispense pipette that features a pistol grip design with push-button actuator. Use this probe with MICROLAB 504 systems. This probe accommodates both 12- and 18-gauge tapered tubing lines with independent extensions. You can extend the tubing out the end of the probe to the length that is convenient for your application; either the right-side or the left-side tubing can be extended to pick up sample. Figure 1–10 shows the Dual Push-button Hand Pipette Probe.

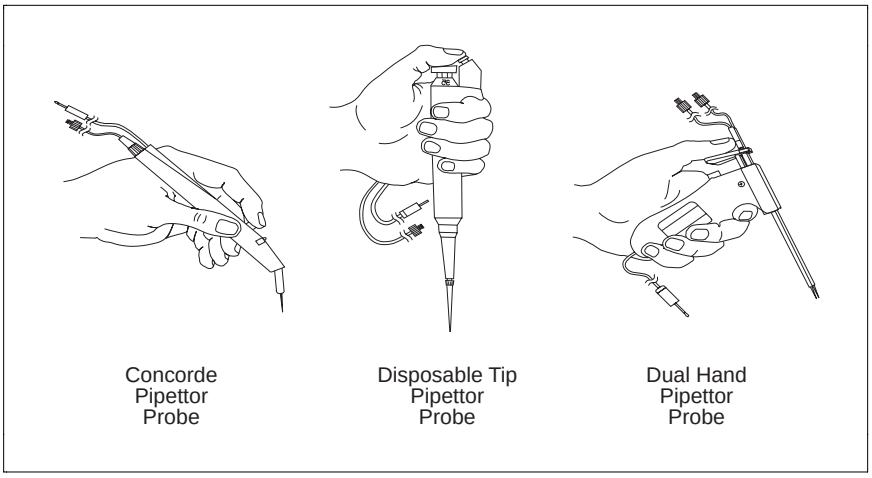
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Disposable Tip Push-button Hand Pipettor/Probes

The Disposable Tip Push-button Hand Pipette Probe is a single-dispense tube pipette that features disposable tips and push-button tip ejection. The Disposable Tip Push-button Hand Pipette Pipettor / Probe is an optional accessory. Use this probe when sample-to-sample carryover is a concern. See Figure 1–10.

Figure 1–10 shows the Concorde, the Disposable Tip, and the Dual Hand Pipettor / Probe.

Figure 1–10 The Concorde, the Disposable Tip, and the Dual Hand Pipettor/Probes



Luer Lock Tip Push-button Pipette Hand Pipettor/Probe

The Luer Lock Tip Push-button Pipette Hand Pipettor / Probe is an optional accessory that dispenses liquids through needles of different lengths and gauges. This probe is useful for controlling very small dispense volumes with a high degree of accuracy. It is also ideal for administering injections to small animals and for piercing septa.

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Viscous Sample Push-button Hand Pipette Pipettor/Probe

The Viscous Sample Push Button Hand Pipettor / Probe is an optional accessory. This single-dispense tube pipette is designed to accommodate highly viscous samples, such as motor oil. This accessory features a disposable 5 mL tip that eliminates sample carryover. Air displacement ensures accurate dilutions.

Footswitch

In addition to the hand-activated probes, a footswitch is also available. The footswitch allows you to operate the MICROLAB 500 via a foot-activated control pedal. This is useful when you need to keep both hands free, as when doing hand-sampling.

Refer to Appendix C for information about ordering the footswitch or any other optional accessories.

Probe Button Functions

The probe button (on any model of hand probe) serves basically the same function as the Run / Stop key on the controller unit. However, you cannot use the probe button to pause an operation or to reinitialize the system after an error occurs.

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Chapter 2 Installing the MICROLAB 500 System

This chapter contains information about installing the MICROLAB 500 system, including the following topics:

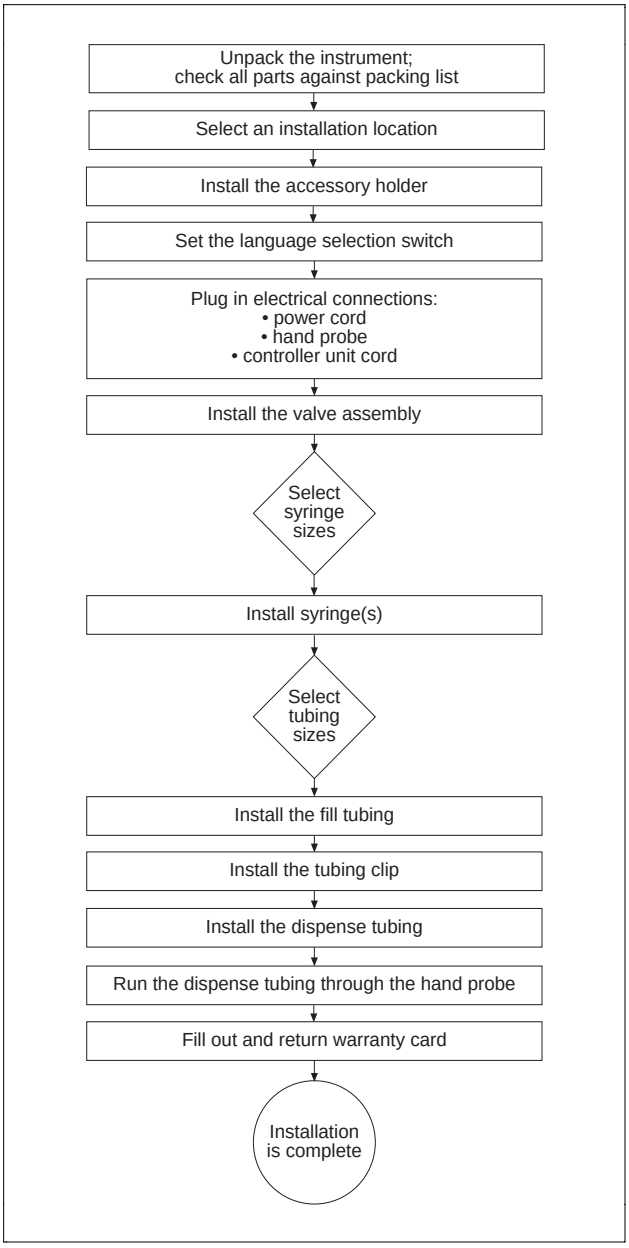
- an overview of installation procedures
- how to select an installation location
- how to install the accessory holder
- how to select the language system messages will display in
- how to install electrical connections
- how to install the valve assembly
- how to select, install, and remove syringes
- how to select and install tubing

▲ **Important** **Be sure to read the instructions in this chapter before installing your MICROLAB system.**

- **Never install or use syringes incorrectly. Incorrect use may result in damage to the syringes. See "Selecting, Installing, and Removing Syringes" later in this chapter for more information.**
- **Never over-tighten tubing. Over-tightening may result in damage to the valves or tubing. See "Selecting and Installing Tubing" later in this chapter for more information.**
- **Call Hamilton Company's Technical/Customer Service Department at (800) 648–5950 (in the United States and Canada) if you have questions about installing your MICROLAB 500 system. ▲**

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Figure 2–1 Overview of Installation Procedures



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Overview of Installation Procedures

Figure 2–1 provides an overview of the MICROLAB 500 installation procedures. These procedures are described in detail in this chapter.

Selecting a Location

Install your MICROLAB 500 system in a clean, dry, level area away from hazardous fumes. Leave space around the unit for ventilation; three inches is sufficient.

Installing the Accessory Holder

All MICROLAB systems come with an accessory holder. You can mount the accessory holder on either the right or the left side of the instrument. Generally, the accessory holder is mounted on the right side and is used to hold a hand probe when the probe is not in use. To install the accessory holder, follow these steps:

1. Locate the threaded holes on either the right or the left side of the instrument.
2. Use a hex wrench and screws (screws are provided) to attach the holder.

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Selecting a Language

The Language Selection switch is located on the back of the drive unit below the serial number label; see Figure 2–2.

To change the displayed language, power the instrument off. Then use a screwdriver to change the switch position. The small bump on the switch indicates the selected position.

By changing the position of the Language Selection switch, you can view message codes in five different languages, including English, French, German, Portuguese, and Spanish. Switch positions for each language are shown in Table 2–1.

Table 2–1 Language Selection Switch Positions

Switch Position	Language
0	English
1	French
2	German
3	Portuguese
4	Spanish

Installing Electrical Connections

Refer to Figure 2–2 and follow these steps to install electrical connections:

1. Plug the power cord into the power connector receptacle on the back of the drive unit. The power cord fits into the receptacle only one way.

   The power connector receptacle accepts cords for either 115V or 220V.

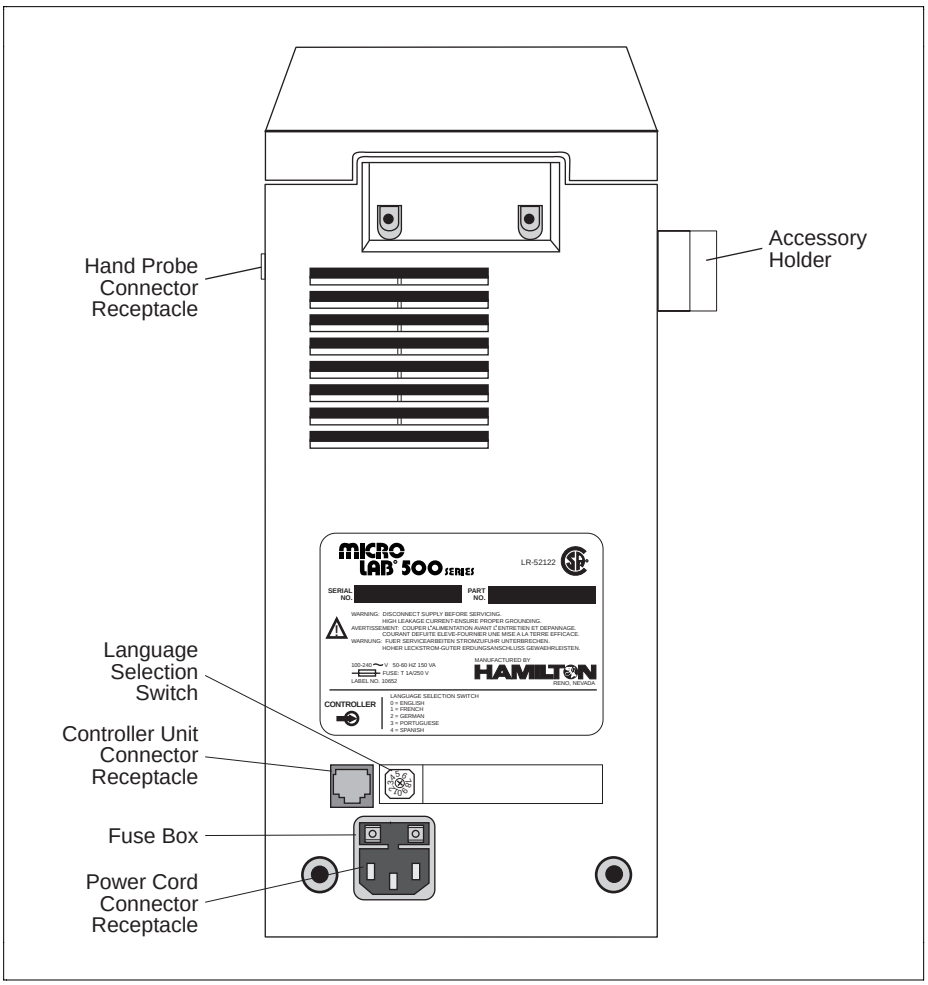
2. Plug the hand probe (or foot pedal) jack into the probe connector receptacle. The probe connector receptacle is located on the upper right side of the drive unit.

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3. The controller connector receptacle is located on the back of the drive unit below the serial number plate.

   Plug the controller cord into the receptacle just as you plug a telephone cord into a telephone outlet. Pinch the plastic locking device on the cord and insert it into the connector receptacle. Then release the plastic locking device, firmly attaching the cord.

Figure 2–2 Installing Electrical Connections



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Installing Valve Assemblies

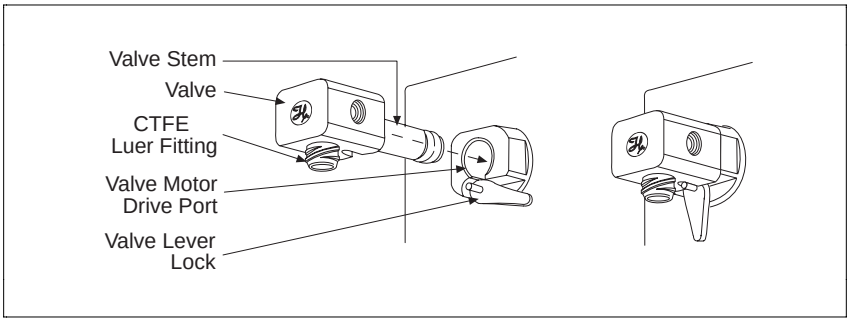
The MICROLAB 501A, 503A, and 504A all use different valve assemblies. Instructions for installing valve assemblies follow.

Installing the Valve Assembly on the MICROLAB 501A

The MICROLAB 501A uses a single active valve assembly. To install the valve assembly, follow these steps:

1. Pick up the valve assembly. Make sure the CTFE luer fitting that attaches to the syringe is on the bottom of the assembly.
2. Holding the valve assembly, align the valve stem opening with the valve motor drive port on the drive unit. Press the valve assembly into place.
3. Push down on the valve lever to lock the valve assembly to the drive unit.

Figure 2–3 Installing a Valve Assembly on the MICROLAB 501A



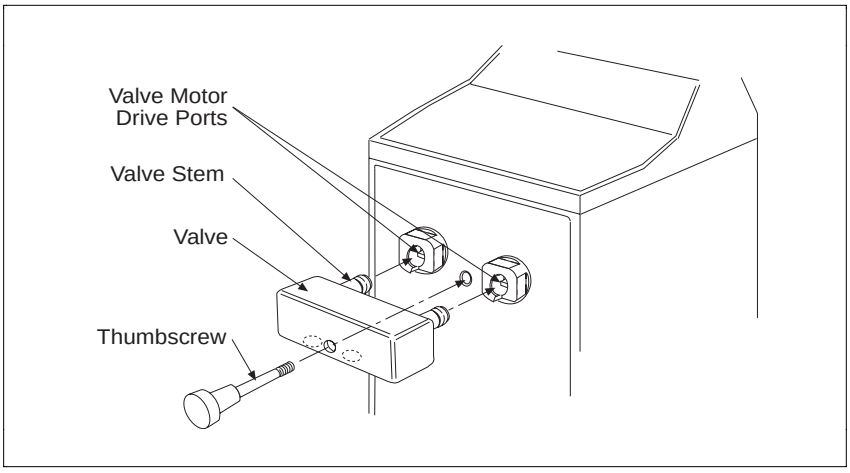
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Installing Valve Assemblies on the MICROLAB 503A and 504A

Although the valve assemblies for the 503A and 504A units are different from one another, their installation procedures are the same. To install a valve assembly on either the MICROLAB 503A or 504A, follow these steps:

1. Pick up the valve assembly. Make sure the CTFE luer fittings that attach to the syringes are on the bottom of the assembly.
2. Holding the valve assembly, align the valve stem openings with the valve motor drive ports on the drive unit. If they do not align, power on and initialize the drive unit. The valve stem openings and the drive ports align when the unit is initialized.
3. Insert the valve assembly into the valve motor drive ports and press the valve assembly into place.
4. Tighten the thumbscrew until it is finger-tight to secure the valve assembly to the drive unit.

Figure 2–4 Installing a Valve Assembly – MICROLAB 503A and 504A



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Selecting, Installing, and Removing Syringes

Before you install syringes on any MICROLAB instrument, you must first decide what syringes to use. Use Tables 2–2 and 2– 3 to select the best syringe for your application. See Figures 2–5 through 2–7 for examples of different syringe types.

- The MICROLAB 501A uses one dispenser / diluent-type syringe in the left position. (TLL-type or TLLX-type syringes.)
- The MICROLAB 504A uses two dispenser / diluent-type syringes—one each in the left and right positions. (TLL-type or TLLX-type syringes.)
- The MICROLAB 503A uses one reagent / diluent syringe in the left position and one sample syringe in the right position. (DX-type sample syringe.)
- As a general rule, to ensure high accuracy and precision, try to use 10% or more of a syringe's total volume. Consider using a different size syringe if your application calls for driving a syringe less than 10% of its total volume and high accuracy and precision are required.

Table 2–2 Reagent/Diluent Syringes (TLL and TLLX-types)

Syringe Sizes	Model Number	Part Number	Optimal Ranges (µL)
25 µL	1702 TLLX	80222	2.5–25
50 µL	1705 TLLX	80922	5–50
100 µL	1710 TLLX	81022	10–100
250 µL	1725 TLLX	81122	25–250
500 µL	1750 TLLX	81222	50–500
1 mL	1001 TLLX	81323	100–1000
2.5 mL	1002 TLL	81420	250–2500
5 mL	1005 TLL	81520	500–5000
10 mL	1010 TLL	81620	1000–10,000
25 mL	1025 TLL	82521	2500–25,000

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Table 2–3 Sample Syringes (DX-type)

Syringe Sizes	Model Number	Part Number	Optimal Ranges (µL)
25 µL	1702 DX	80226	2.5–25
50 µL	1705 DX	80926	5–50
100 µL	1710 DX	81026	10–100
250 µL	1725 DX	81126	25–250
500 µL	1750 DX	81226	50–500
1 mL	1001 DX	81326	100–1000

See Appendix C for information regarding replacement parts for TLL, TLLX, and DX syringes.

Figure 2–5 The TLL-type Dispenser/Diluent Syringe

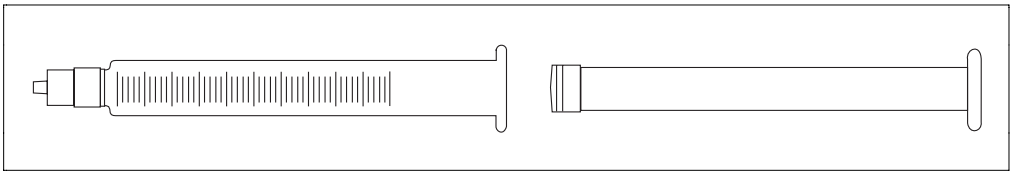


Figure 2–6 The TLLX-type Dispenser/Diluent Syringe

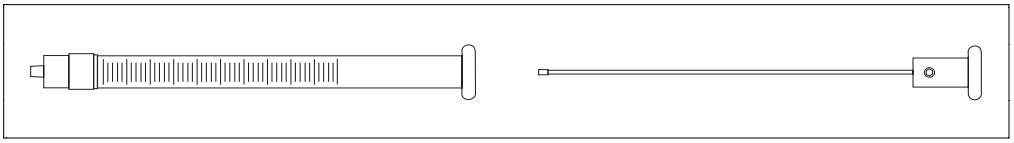
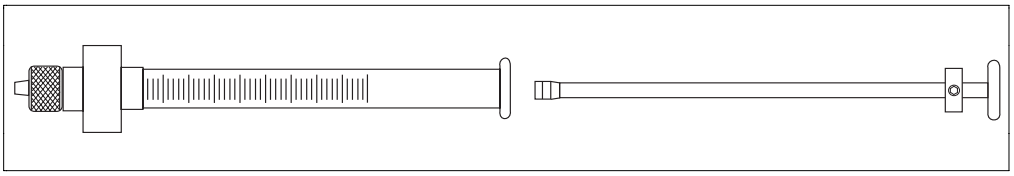


Figure 2–7 The DX-type Sample Syringe



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Preparing Syringes for Installation

When you unpack a new syringe, notice that the syringe plunger is packed separately from the syringe barrel. You must condition the plunger tip before inserting the plunger into the barrel.

▲ **Important** **Before using a new syringe for the first time, you must condition the syringe's PTFE plunger tip and glass barrel. To condition the tip and barrel, wet the plunger tip with distilled water or a solvent. (Medical-type silicone lubricants may be used to extend the lives of PTFE plunger tips. However, silicone may contaminate the plunger tips.) Do NOT use viscous oils to lubricate plunger tips.**

After wetting the plunger tip, insert the plunger into the glass barrel. Move the plunger in and out of the glass barrel approximately 10 times. Apply steady and even pressure; avoid twisting movements. ▲

Installing Syringes

Follow these steps to install syringes on any MICROLAB 500 system.

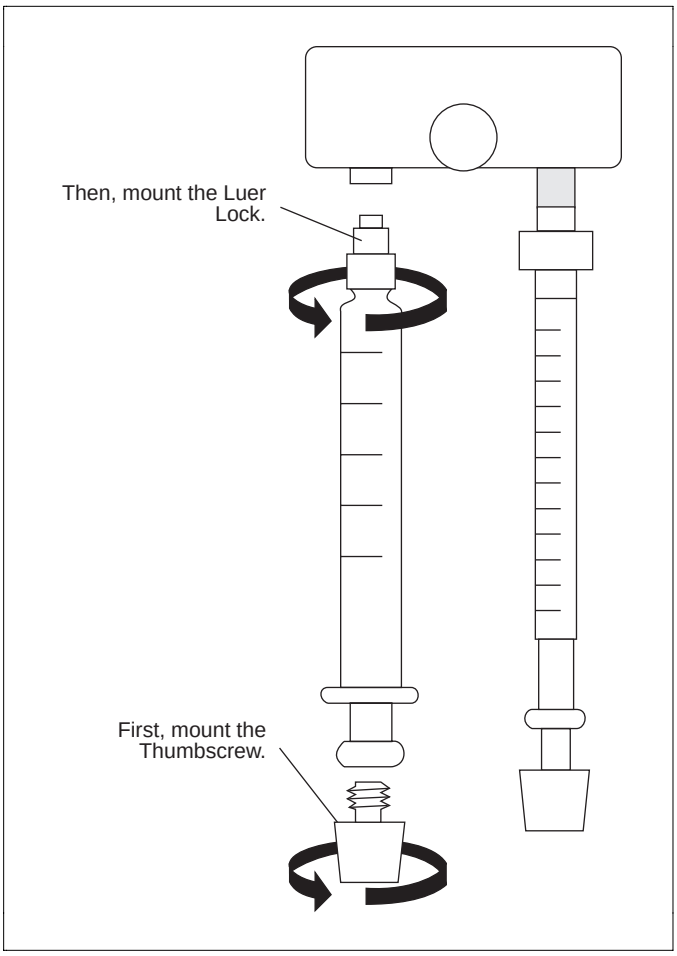
1. Condition all syringes before installation by following the procedure described in "Preparing Syringes for Installation."
2. Power on the MICROLAB system using the Power On/Off switch.
3. Press and hold the Step/Prime switch in the Step position, and move the syringe drive arm down from the Home position. Release the switch when the drive arm is about half-way between Home and the Down position.

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4. Fasten the thumbscrew on the drive arm to the bottom of the syringe plunger. To fasten the thumbscrew, hold the plunger and screw the thumbscrew into the threaded fitting at the bottom of the syringe.
5. Pull the glass barrel up straight to the threaded female luer fitting that extends down from the bottom of the valve. Insert the male luer fitting into the valve fitting and turn the glass barrel clockwise until it is “finger-tight.”

See Figure 2–8, Installing a Syringe, for an illustration of these steps.

Figure 2–8 Installing a Syringe



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▲ **Important** **Always tighten syringes so they are "finger-tight." Syringes that are over- or under-tightened can cause problems for your MICROLAB 500 system.**

- **Syringes that are over-tightened may cause leaks or may damage the valve.**
- **Syringes that are under-tightened may cause leaks.**
- **Syringes that are not screwed on straight may leak and cause lateral strain on the syringe luer fitting as it connects to the bottom of the valve.** ▲

Removing Syringes

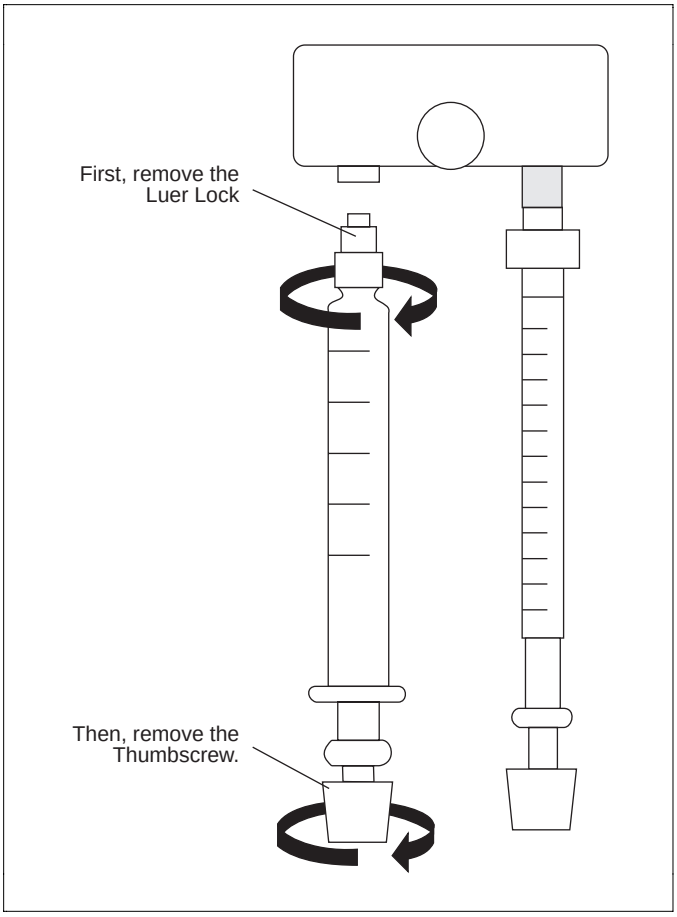
To remove syringes, reverse the installation procedure.

1. Power on the system using the Power On / Off switch.
2. Use the Step / Prime switch to move the syringe drive arm down from the Home position. Release the switch when the drive arm is about half way between Home and the Down position.
3. Release the glass barrel by turning it counterclockwise.
4. Unfasten the thumbscrew on the drive arm at the bottom of the syringe plunger. To unfasten the thumbscrew, hold the plunger and unscrew the thumbscrew from the threaded fitting at the bottom of the syringe.

Refer to Figure 2–9, Removing a Syringe, for an illustration of the removal procedure.

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Figure 2–9 Removing a Syringe



⚠ **Warning! Avoid the risk of injury or infection! Use extreme caution when removing cracked or splintered syringes. Always wear thick gloves and protective eye wear when replacing syringes.** ⚠

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Selecting and Installing Tubing

This section provides information about selecting and installing tubing on all MICROLAB 500 systems.

Selecting Tubing

Each MICROLAB system includes two gauges of fill and dispense tubing: 12- and 18-gauge. Fill tubing has a 90˚ cut on the end opposite the fitting; dispense tubing has a tapered end opposite the fitting.

When selecting tubing, consider the volume and the viscosity of the liquid you plan to pipette. Refer to Table 2–3, Tubing Selection Guide, for help in selecting tubing.

Table 2–4 Tubing Selection Guide

Syringe Size	Tubing Gauge for Standard Aqueous Solutions	Tubing Gauge for Viscous and Foaming Liquids
25 µL	18	18
50 µL	18	18
100 µL	18	18
250 µL	18	18
500 µL	18	18
1 mL	18	18
2.5 mL	18	12
5 mL	12	12
10 mL	12	12
25 mL	12	12

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✶ **Note: If you have a MICROLAB 503A diluter and plan to use syringes of two different sizes, choose tubing to accommodate the syringe with the larger volume.** ✶

See Appendix C for information about ordering extra tubing.

Installing Tubing

1. Before installing tubing lines, wet the tubing fittings.
2. Make sure the tubing lines do not contain crimps or blockages. Crimps or blockages can cause leaks or can cause the system to overload. If tubing is crimped, replace it with new tubing.

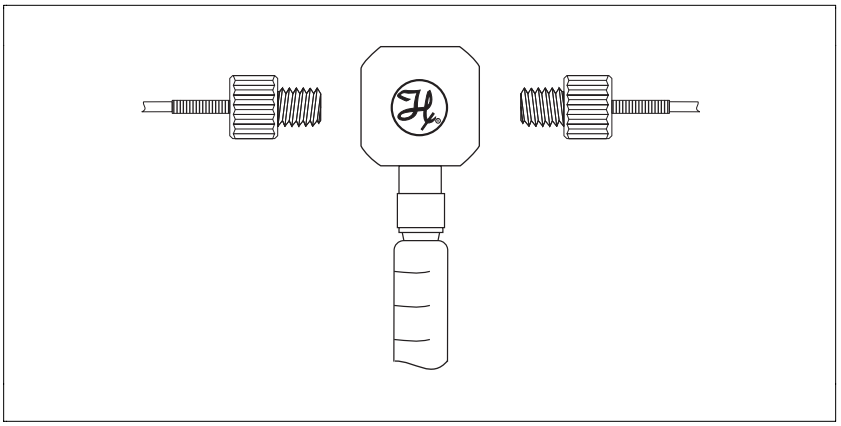
▲ **Important** **Fasten tubing so it is finger-tight and snug enough to prevent leaks. Avoid using tools to tighten tubing. Excessive tightening may damage tubing or valve fittings or flanges.** ▲

3. Install the fill tubing. You can differentiate fill tubing and dispense tubing since dispense tubing has a tapered end.
   - For all MICROLAB 500 models, install the fill tubing on the left side of the valve. Thread the tubing fitting into the left valve port, and screw it in so it is finger-tight.
   - For the MICROLAB 504A only, install a second fill tubing line on the right side of the valve. Thread the tubing fitting into the right valve port, and screw it in so it is finger-tight, just as you did on the right side.
4. Once the fill tubing is installed, attach a tubing clip to it. Slip the tubing clip over the end of the tubing, then attach the clip to the side of the reservoir.

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5. Install the dispense tubing. You can recognize dispense tubing by its tapered end.
   - If you are using a MICROLAB 501A, install the dispense tubing on the right side of the valve. Thread the tubing fitting into the right valve port and screw it in so it is finger-tight. See Figure 2–10 for an illustration of the valve and tubing connectors.

Figure 2–10 MICROLAB 501A Valve and Tubing Connections



   - If you are using a MICROLAB 503A with a D syringe, install the dispense tubing on the side port of the D syringe. See Figure 2–11. When using a TLL syringe as a sampling syringe, install dispense tubing directly onto the valve assembly. To do this, remove the valve plug and replace the plug with dispense tubing. See Figure 2–12.

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Figure 2–11 MICROLAB 503A Valve with a D Configuration Syringe

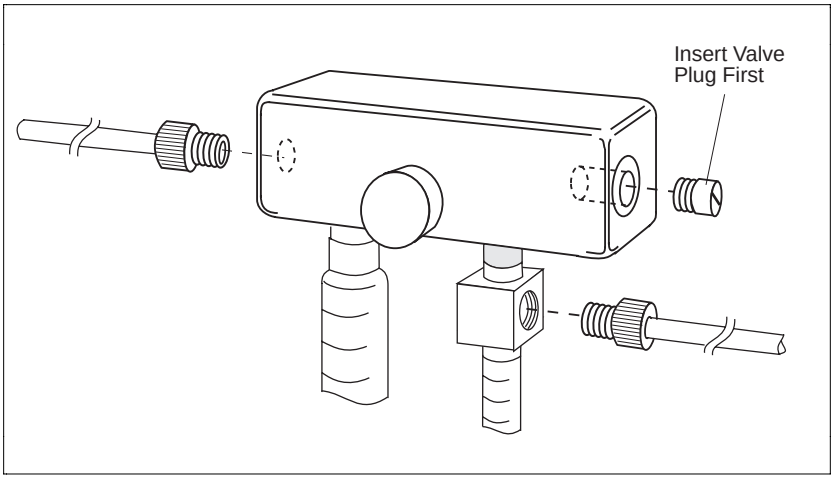
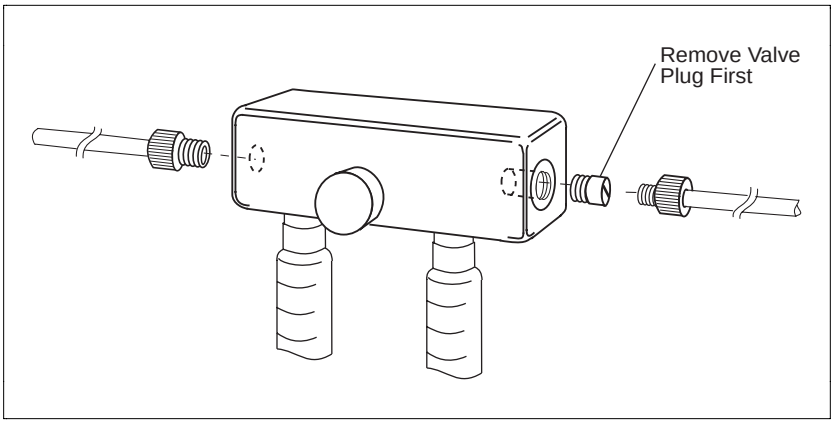


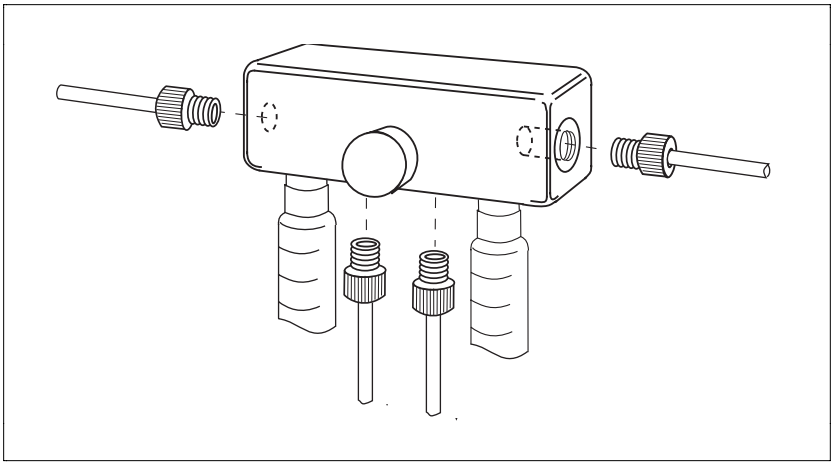
Figure 2–12 MICROLAB 503A Valve with Two TLLX or TLL Syringes



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– If you are using a MICROLAB 504A, install a tapered dispense tubing line into each of the valve's front ports. The front ports are located on the bottom of the valve between the two syringes. Thread the tubing fittings into the front ports, and screw the fittings in so they are finger-tight. See Figure 2–13.

Figure 2–13 MICROLAB 504A Valve and Tubing Connectors



▲ **Important** **There are two methods of using the MICROLAB 504A dual dispenser as a single dispenser.**

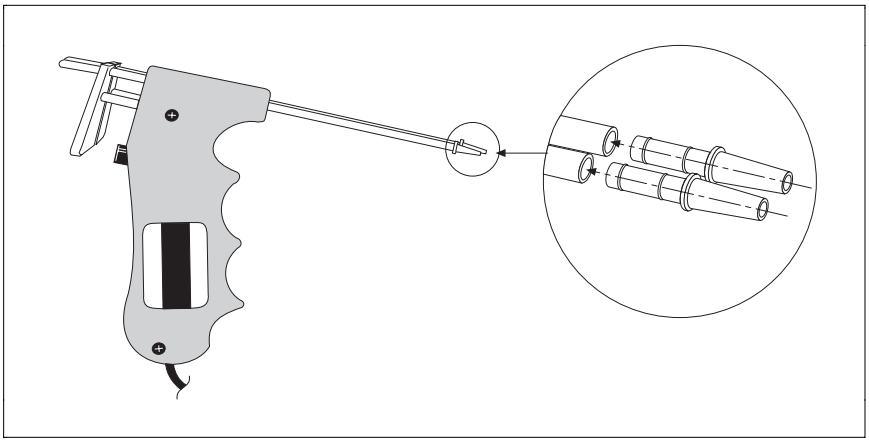
Method 1: Install dispense tubing on the unused side of the instrument and pull in distilled water from a reservoir. Cycle the distilled water through the unused side. Dispense the water back into the same reservoir or into a waste container. Do not run the unused side dry.

Method 2: Set the syringe size on the left or the right side syringe to 0 (zero). The side that is set to 0 remains idle when you operate the instrument. ▲

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6. Install the dispense tubing to the hand probe.
   - If you are using the MICROLAB 501A or the MICROLAB 503A, the Concorde Probe comes as standard equipment. This probe uses a single dispense tube. To attach the dispense tubing into the probe, loosen the knurled screw at the upper end of the probe. Slide the tapered end of the dispense tube through the probe so that the tubing passes out the end of the probe. When enough tubing for you to work with extends from the probe, tighten the knurled screw to secure the tubing line.
   - If you are using the MICROLAB 504A, the Dual Hand Probe comes as standard equipment. This probe is designed for both 18- and 12-gauge tubing. Use the tubing reducer (Part # 35770) that is provided with the dual hand probe if you wish to use 18-gauge tubing. See Figure 2–14.

Figure 2–14 Using the Tubing Reducer with the Dual Hand Probe



7. Fill out the warranty card and return it to Hamilton Company.
8. You are now ready to use your MICROLAB 500 system.

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Chapter 3 Using the MICROLAB 500 System

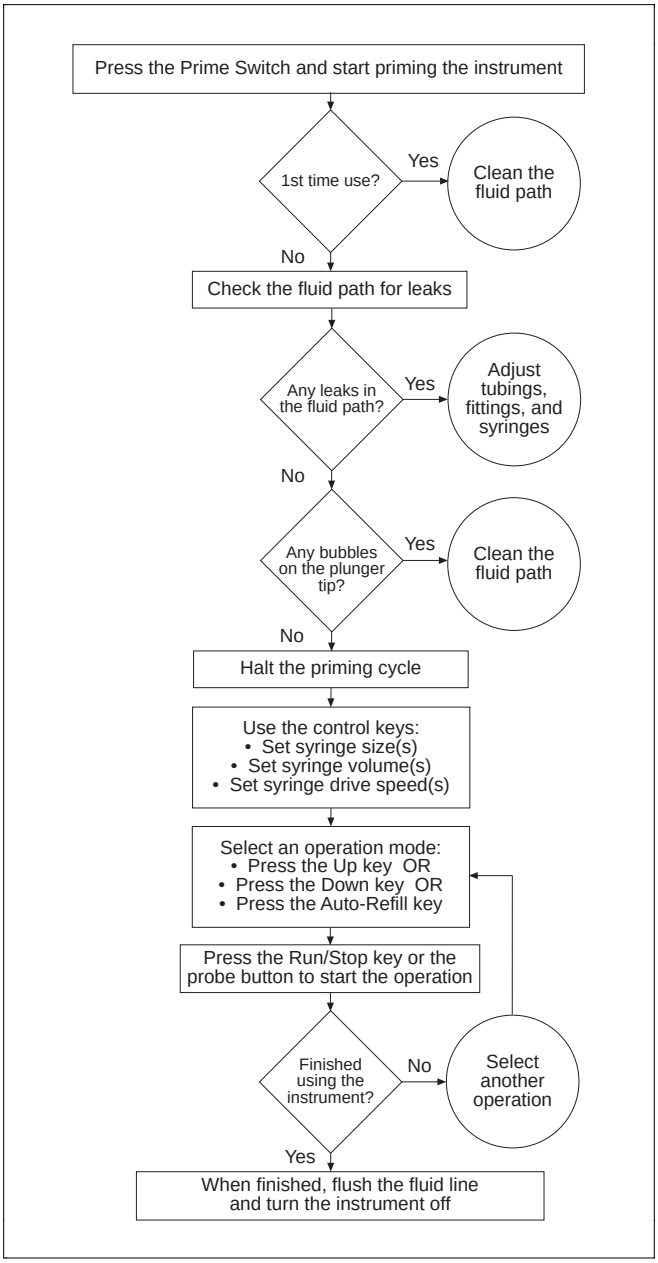
This chapter contains information about the following topics:

- using the system—an overview
- powering on the MICROLAB 500 and default values at start up
- priming and checking the system
- using the control keys:
  - setting syringe sizes
  - setting syringe volumes
  - setting syringe drive speeds
- sample applications

✶ **Note: When using the MICROLAB 500 system, always take care to keep the instrument clean. Follow all instructions for using and handling the system.** ✶

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Figure 3–1 Using the MICROLAB 500



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Using the System—An Overview

Before using your MICROLAB 500 system, be sure you have followed the installation instructions in Chapter 2, Installing the MICROLAB 500. Figure 3–1 provides an overview of using the system.

Powering On the MICROLAB 500

To power on the MICROLAB 500, press the Power On / Off switch located on the front panel of the drive unit. When the instrument powers up, it performs an electronic self-test, beeps twice, and displays the following message on the controller unit:

```
Size?
```

✶ **Note: The actual text of this message will vary according to the language you selected using the language selection switch. For more information, refer to "Selecting a Language" in Chapter 2.** ✶

This message means that the MICROLAB is ready and waiting for you to enter the sizes of the syringes that are installed on the drive unit (see Chapter 2, Installing the MICROLAB 500). If you wish to run an operation, you must enter a size for at least one of the installed syringes. Until you enter a size, only the Syringe Size keys and the Increase and Decrease keys are available for use. The MICROLAB 500 will not operate without at least one syringe size value. See "Setting Syringe Sizes" later in this chapter for information about setting syringe sizes.

The first time you press the Run / Stop key after the system is powered on and after you have entered at lease one syringe size, the system will initialize itself. Until the system initializes itself, Up is the only available operation.

✶ **Note: You can prime the instrument without entering a syringe size, however, you cannot run an operation without first entering at least one syringe size.** ✶

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Priming and Checking

Prime the MICROLAB system before using it for the first time, at the start of a work day, and between fluid changes. Run fluid through the tubing lines to ensure that there are no bubbles or air gaps in the tubing. Check the fluid path for leaks and clean the fluid path, if necessary.

To prime the MICROLAB and check the fluid path for leaks, follow these steps:

1. Fill a reservoir with deionized water. Place the end of the inlet tubing in the reservoir. Use the tubing clip to attach the tubing to the side of the reservoir.
2. Place the hand probe over the same reservoir or over a waste container.
3. Push the Prime switch on the drive unit.
4. Run the instrument in Prime mode until water flows through the entire system.
5. If the system is airtight, the fluid path will contain a solid column of water.
   - If you see air bubbles in the fluid path, the system is not airtight. Adjust the tubing fittings or syringes. Check that all parts are snug and finger-tight.
   - If you do not see air bubbles in the fluid path, the system is airtight.
6. If you do not see air bubbles in the fluid path, but small bubbles appear on the PTFE surface of the syringe, clean the internal fluid path with a mild syringe cleaner. Empty out the soapy water and rinse with deionized water to rid the system of cleaning fluid. To clean the fluid path, follow the steps in Chapter 4, Caring for the MICROLAB 500.
7. After cleaning, reprime with deionized water to rinse the fluid path. Continue priming until you do not see any bubbles.
8. Remove the inlet tubing from the reservoir and prime air through the system. Priming air through the system clears the fluid path of the deionized water that you used as a rinse.

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9. When the fluid path is free of deionized water, place the inlet tubing into a reservoir of the liquid you wish to dispense or use as a diluent. Prime this fluid through the system.

✶ **Note: When priming reagent after a deionized water rinse, dispense the first shot into a waste container, since it will contain a certain amount of the water droplets that remained in the tubing line.** ✶

10. Your MICROLAB system is clean and ready for use.

▲ **Important** **When priming the MICROLAB 504A dual dispenser, always prime both syringes at the same time, or set the volume of the unused side to zero. Do not operate either syringe dry, as this may cause excessive wear on the syringes and valves.** ▲

Default Values

The MICROLAB 500 assumes certain default values when it is powered on. The system uses these speeds unless you change the speed of the syringe drive arm by using the Syringe Speed keys and the Increase or the Decrease key.

- The *Syringe Size* key is active by default with a value of 1000 mL. If you are using a dual syringe instrument, the left-side Syringe Size control is active. You must enter a size for at least one of the installed syringes before you can operate the instrument. If you are using a dual-syringe instrument and do not enter a size for the second syringe, it remains inactive.
- *Syringe Volume* defaults to 100% of the volume of the installed syringe, if you do not enter a specific volume.
- Drive arm *Speed* defaults to various values based on the size of the installed syringe. See Table 3–1, Default Syringe Speed Values, for a list of the default speed values.

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Table 3–1 Default Syringe Speed Values

Syringe Size	Syringe Speed (seconds per stroke)
25 µL	2
50 µL	2
100 µL	2
250 µL	2
500 µL	3
1 mL	3
2.5 mL	4
5 mL	5
10 mL	6
25 mL	8

Using the Control Keys

Use the control keys to enter specific information about your application, such as the sizes of the installed syringes, the volumes to be pipetted, the drive arm speeds, and the desired operation.

You can change the value of any control key or you can switch operations after the current operation completes.

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Setting Syringe Sizes

✶ **Note: You must enter a size for the syringe(s) that are installed on the drive unit. If you are using a dual syringe instrument, you must enter a size for at least one of the syringes. If you do not enter a size for the second syringe, it remains inactive.** ✶

To enter a syringe size, follow these steps:

1. Press the left or the right Syringe Size key. (The left-side Syringe Size key is active by default when you power-on the MICROLAB 500.)

   When you press a Syringe Size key, the Control Indicator, a small green light next to the key, lights up to show you that the key is active.

2. To increase a syringe size, press the Increase key; to decrease a syringe size, press the Decrease key. As you press either of these keys, the Syringe Size Indicator lights move to indicate the selected size and the size itself appears in the Message Display Windows. As you press the Increase / Decrease key, the displays change continuously. When either the highest or the lowest size limit is reached, the displays automatically "wraps around", enabling you to quickly select the correct size for your needs.

   When setting syringe sizes, you can choose from 10 different sizes that correspond to Hamilton syringes: 25 µL, 50 µL, 100 µL, 250 µL, 500 µL, 1000 µL, 2500 µL, 5000 µL, 10,000 µL, and 25,000 µL. The default value is 1000 µL.

✶ **Note: Above 500 µL, the Syringe Size Indicator light shows the syringe size in milliliters, while the display window shows the same size in microliters.** ✶

3. When you reach the size you need, release the Increase or the Decrease key.
4. Verify your selection by checking the size that appears in the message display windows.
5. If you are using a dual syringe instrument, repeat steps 1 through 4 for the second syringe.

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Setting Syringe Volumes

You can specify a volume only after you have selected and entered a size for the corresponding syringe.

To set a volume, follow these steps:

1. Press the left or the right Volume key. When you press the Volume key, the Control Indicator, a small green light next to the key, lights up to show you that the key is active.

   By default, volume appears as 100% of the corresponding syringe; 100% is the maximum allowable volume.

   If you enter a volume of 0 (zero), the corresponding syringe remains inactive. Enter a volume greater than zero to activate the syringe.

2. To increase or decrease a volume, press the Increase or Decrease key. You can select any volume in increments of 0.1% of the corresponding syringe. As you press the Increase / Decrease key, the display changes continuously. When either the highest or the lowest volume limit is reached, the display automatically "wraps around", enabling you to quickly select the correct volume for your needs.
3. When you reach the volume you need, release the Increase or the Decrease key.
4. Verify your selection by checking the volume that appears in the message display windows.

✶ **Note: If you enter a new size for a syringe, volume automatically changes to 100% of the new size.** ✶

5. If you are using a dual syringe instrument, repeat steps 1 through 4 for the second syringe.

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Setting Syringe Drive Speeds

To change the speed of a drive arm, follow these steps:

1. Press the left or the right drive arm Speed key by pressing it. When you press a Speed key, the Control Indicator, a small green light next to the key, lights up to show you that the key is active.
2. To increase or decrease the Speed, press the Increase key or press the Decrease key. As you press the Increase/Decrease key, the display changes continuously. When either the highest or the lowest speed limit is reached, the display automatically "wraps around", enabling you to quickly select the correct speed for your needs. Choose a drive speed anywhere from 2 to 20 seconds per full stroke.

✶ **Note: Use slower drive speeds when pipetting large volumes and/or viscous or volatile liquids. Slower drive speeds improve accuracy and precision.** ✶

3. When you reach the desired speed, release the Increase or the Decrease key.
4. Verify your selection by checking the speed that appears in the message display windows.
5. If you are using a dual syringe instrument, repeat steps 1 through 4 for the second syringe.

Running Operations

When you press the Run/Stop key the first time after the system is powered on and after you have entered syringe sizes, the system initializes itself. (That is, the drive arms move up to the Home position.) Until the system initializes itself, Up is the default operation. After initialization, Down becomes the default operation.

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After you have entered any required values for the control keys, and the system has initialized itself, you may select an operation (Down or Auto-Refill). Press the desired operation key and then press the Run / Stop key or the probe button to start the operation. The system beeps once at the start of each new operation.

When a Down stroke completes (this could be at any location within the drive arm's range of movement, depending on your specific application), the operation automatically changes to Up. When the Up stroke completes and the syringe drive arms return to the Home position, the operation automatically changes to Down. If using a dual syringe instrument, both drive arms must return to the Home position. Otherwise, Up remains the active operation.

When an operation completes, and if no volume settings have been changed, the volume settings will be reused for the next operation. If the volume settings exceed the volumes remaining in the syringes, the operation will not execute. Instead, the "Exceeds Volume" error message will appear in the display windows. Use the Run / Stop key or the Step / Prime switch to reinitialize the system, then enter new volume settings.

Press the Run / Stop key to reinitialize the system after any error occurs. You cannot use a probe button to reinitialize the system after an error occurs. See Chapter 5 for more information about system messages and error recovery.

Pausing Operations

If Up, Down, or Auto-Refill is selected, you can pause the instrument during a stroke by pressing the Run / Stop key once. Resume the operation by pressing the Run / Stop key again. To cancel a paused operation, press any key except the Run / Stop key. If you cancel an operation and then press the Run / Stop key, the drive arms will move to the Home position.

If the Step / Prime switch (on the drive unit) is in use and is in the Prime position, you cannot use the Run / Stop key to pause during a stroke or a cycle. Instead, pressing Run / Stop causes the drive arms to continue their movement until they reach the Home position. Then they stop.

You cannot use a probe button to pause an operation.

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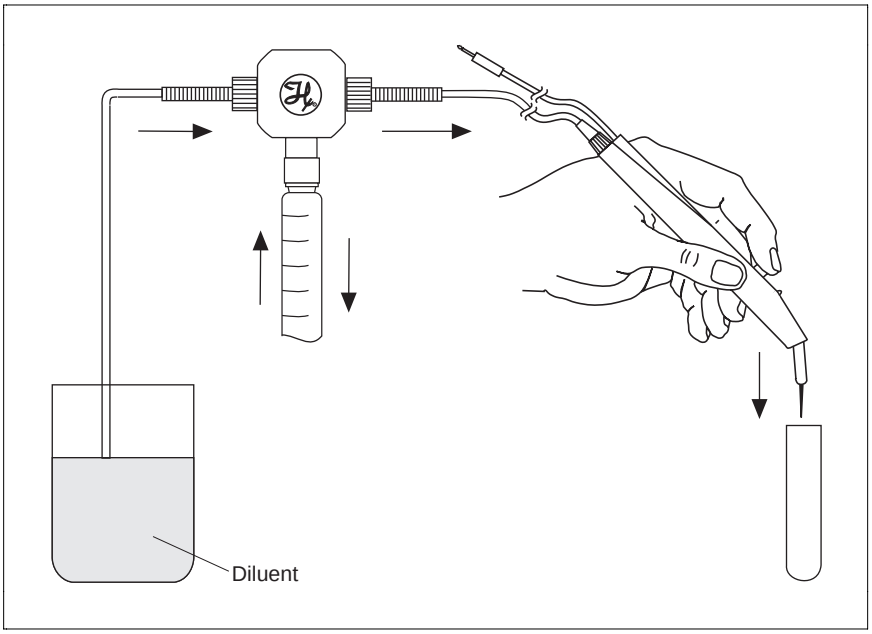
Sample MICROLAB 501A Application Configurations

Single Syringe Dispensing

When the probe button is pressed once, fluid is pulled from the reservoir into the TLL syringe. The valve then switches to connect the fluid path from the TLL syringe to the hand probe.

When the probe button is pressed a second time, liquid is dispensed out of the probe tip. Figure 3–2 shows the Concorde Probe being used for single syringe dispensing.

Figure 3–2 Single Syringe Dispensing



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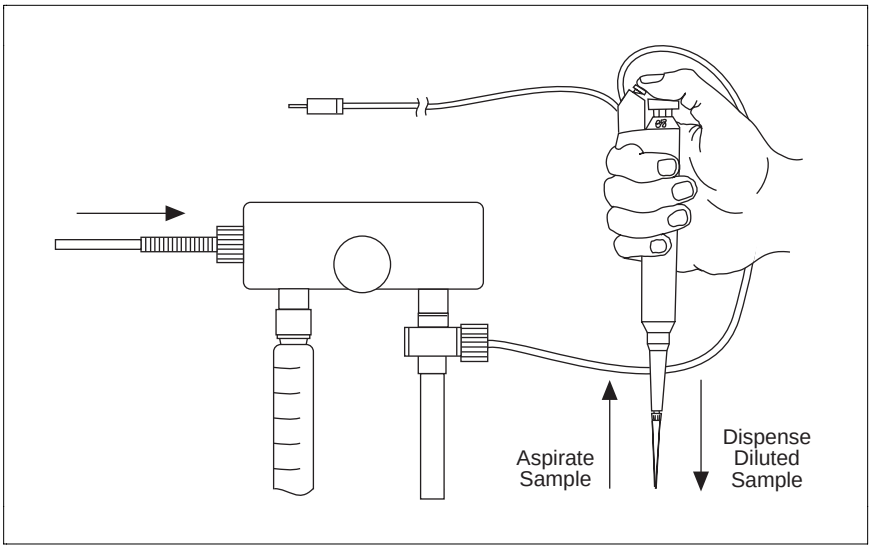
Sample MICROLAB 503A Application Configurations

Example 1: Dilutions

When the probe button is pressed once, the syringe drive arms move down, pulling diluent in from the reservoir, and aspirating sample into the probe tip. Then, the valve reverses and connects the fluid path from both syringes to the hand probe.

When the probe button is pressed a second time, the syringe drive arms move up. Sample and diluent are dispensed and mixed together, creating a dilution. Figure 3–3 shows the Disposable Tip Probe being used for dilutions.

Figure 3–3 Dilutions

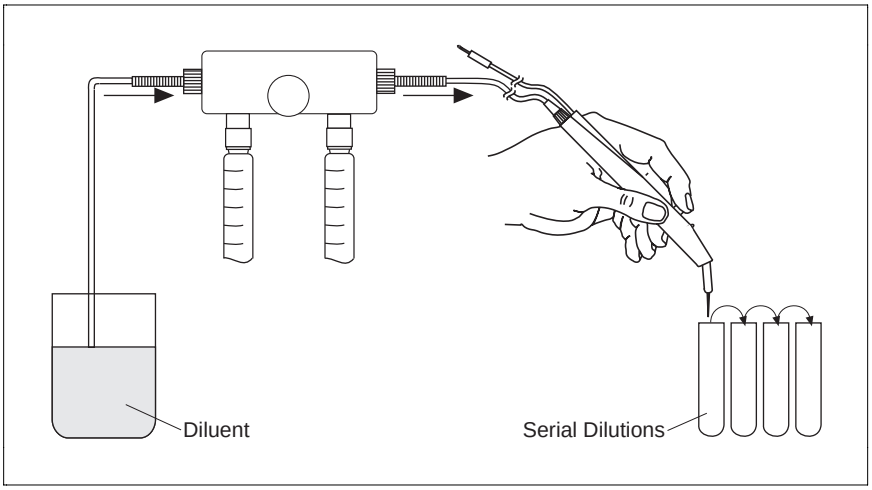


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Example 2: Dilutions

MICROLAB 503A Example 2 follows the same procedures as those shown in the MICROLAB 503A Example 1, except that two TLL syringes are used and the dispense tubing is connected directly to the side of the valve assembly. To attach tubing directly to the valve assembly, remove the plug on the side of the valve. Replace the plug with tubing. Figure 3–4 shows the Concorde Hand Probe being used for serial dilutions.

Figure 3–4 Serial Dilutions



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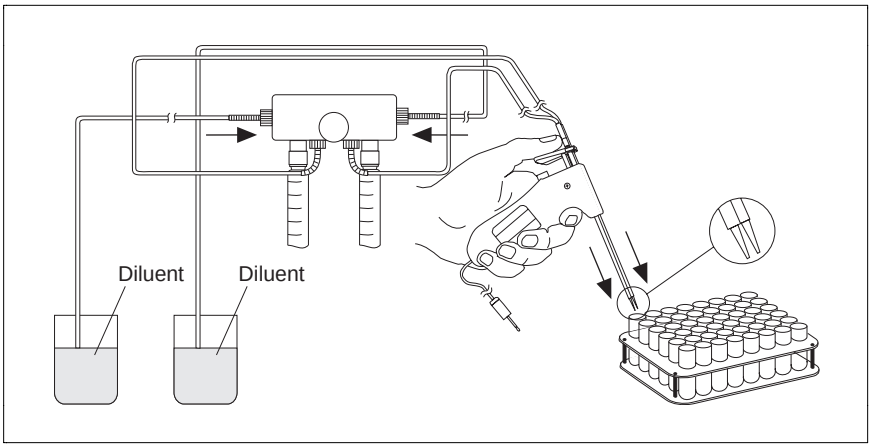
Sample MICROLAB 504A Application Configurations

Example 1: Dual Dispensing

When the probe button is pressed once, the syringe drive arms move down, pulling in two different liquids from two different reservoirs. The valves then reverse and connect the fluid path from the syringes to the hand probe.

When the probe button is pressed a second time, the syringe drive arms move up, dispensing the two liquids out of separate tubing lines. Figure 3–5 shows the Dual Hand Probe being used for dual dispenses.

Figure 3–5 Dual Dispensing

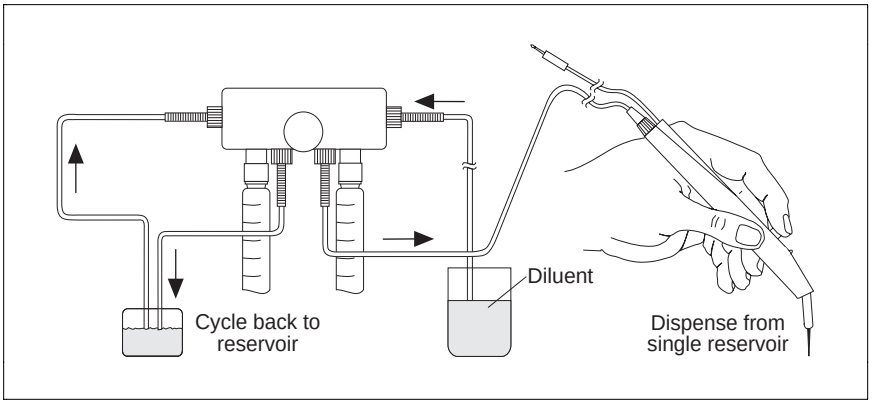


Example 2: Using the Dual Dispenser for Single Dispensing

MICROLAB 504A Example 2 follows the same procedures as those shown in the MICROLAB 504A Example 1, except that liquid is dispensed out of the right side only. On the left side, a liquid is cycled from the reservoir, through the fluid path, and back again simply to lubricate the fluid path. Figure 3–6 shows the Concorde Hand Probe being used for single dispensing.

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Figure 3–6 Using the Dual Dispenser for Single Dispensing



✶ **Note: After the syringe size is set, the right or left syringe can remain idle if the fill and the dispense volume for that syringe is set to 0 (zero). Do not operate either syringe dry, as this may cause excessive wear on the syringes and valves.** ✶

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Chapter 4 Caring for the MICROLAB 500

This chapter contains instructions on routine maintenance procedures for the MICROLAB 500, including the following topics:

- deciding when to clean the MICROLAB 500
- how to clean the fluid path
- how to clean syringes and tubing
- how to clean the exterior of the system
- how to store the system
- chemical compatibility of the system

✶ **Note: Call Hamilton Company's Technical Customer Service Department at (800) 648–5950 (in the United States and Canada) if you have questions about maintaining your MICROLAB 500 system.** ✶

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Deciding When to Clean the MICROLAB 500

How often you clean the MICROLAB depends upon how you use the instrument and what you use in it.

We recommend that, if you use the instrument daily, the tubing and syringes should be purged and primed at the end of each experiment and each work shift. Clean the system by flushing it with Hamilton Syringe Cleaner, ethanol, or a with a 10% chlorine bleach and deionized water solution. Avoid using caustic or acidic cleaning solutions.

▲ **Important** **Leave the syringes and tubing filled with deionized water overnight. This is important if you are using buffers or other salt solutions which could accumulate or crystallize in the system. If buffers or other salt solutions are left in the fluid path overnight, crystals may form and damage the syringe plunger tip.** ▲

See "Cleaning the Fluid Path of MICROLAB 500" for complete details on cleaning the fluid path. If you still have questions, contact Hamilton Company's Technical/Customer Service Department at (800) 648-5950.

Cleaning the Fluid Path of the MICROLAB 500

Clean the MICROLAB 500's fluid path before using it for the first time. Use Hamilton Syringe Cleaning Solution to clean the fluid path. See Appendix C for information on ordering Hamilton Syringe Cleaner.

To clean the fluid path, follow these steps:

1. Prepare a reservoir of cleaning fluid and place the fill tubing in the cleaning fluid reservoir. Use a tubing clip to secure the tubing to the side of the reservoir.
2. Place the hand probe into the cleaning fluid reservoir or a waste container.

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3. Press the Step / Prime switch on the drive unit to start the priming cycle.
4. Continue the priming cycle until the fluid path is clean. The number of cycles needed to clean the fluid path will depend on the sizes of the syringes and the dirtiness of the system.
5. When the fluid path is clean, press the Step / Prime switch back to the middle position to stop the priming cycle.
6. Move the inlet tubing from the cleaning fluid reservoir and place it into a reservoir of deionized water.
7. Press the Step / Prime switch to continue the priming cycle.
8. Continue the priming cycle until the fluid path is free of all cleaning fluid. Dispense the rinse fluid into a waster reservoir.
9. Press the Step / Prime switch to the inactive position to stop the priming cycle.
10. Press the Step / Prime switch to the Step position and advance the syringe drive arm to the Home position.
11. The system is now clean and ready for use.

✶ **Note: When priming reagent after a deionized water rinse, dispense the first shot into a waste container, since it will contain a certain amount of the water droplets that remained in the tubing line.** ✶

Cleaning Syringes and Tubing

⚠ **Warning! Follow your laboratory's safety procedures if you use the MICROLAB 500 system to handle hazardous materials.** ⚠

When tubing and syringes come in contact with contaminated or hazardous samples, follow safe laboratory practices in selecting and using a cleaning fluid to flush out the tubing and syringes. Purge, clean, and decontaminate the MICROLAB 500 by thoroughly flushing out all portions of the tubing and syringes.

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Use a cleaner that is compatible with the fluids previously run through the system. Depending on the sample that is being run, you may want to use de-ionized water, urea, ethanol, or a 10% chlorine bleach and deionized water solution as a cleaning fluid.

Clean syringe plunger tips by soaking them in Hamilton Syringe Cleaning Solution. If you still have questions, contact Hamilton Company's Technical/Customer Service Department at (800) 648-5950 (in the United States and Canada).

Cleaning the Exterior of the MICROLAB 500

⚠ **Warning! Follow your laboratory's safety procedures if you use the MICROLAB 500 system to handle hazardous materials.** ⚠

The MICROLAB 500 housing is moderately inert to chemical exposure. However, some chemicals may discolor the surface of the unit.

If a spill occurs on the instrument's exterior, wipe the surface immediately. Wash the surface using a damp cloth with water and soap **or** use a SANI-CLOTH™. Then dry the area. Take care that liquids do not enter the interior of the MICROLAB 500.

To disinfect the exterior surface, wipe it down with a 10% chlorine bleach and deionized water solution. Then dry the area.

✶ **Note: The cleaning guidelines presented here are meant as guidelines only. If your particular applications require different cleaning solutions, contact Hamilton Company for more information.** ✶

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Chemical Compatibility

The MICROLAB 500's fluid path consists of PTFE-based materials and borosilicate glass. These materials are resistant to a wide variety of acids and bases at room-to-moderate temperatures. Most chemicals do not affect PTFE at normal operating temperatures.

▲ **Important** **Do not use the MICROLAB 500 for prolonged periods at high temperatures with aromatic or highly halogenated compounds. These compounds may cause the MICROLAB's fittings to swell, adversely affecting performance and reducing the life of system components. Appendix D, Chemical Compatibility of the MICROLAB 500, provides a list of chemicals and their compatibility with the MICROLAB 500 system.** ▲

If you have any questions about chemical resistance to specific compounds, please contact the Hamilton Company; check out any unusual or reactive compounds before using them with your MICROLAB 500 system.

Storing the MICROLAB 500

For long-term storage, prime and purge the system with methanol to facilitate drying. Remove the tubes and syringes. Cover the instrument to protect it from damage. Store syringes in their original containers.

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Chapter 5 Troubleshooting the MICROLAB 500

This chapter contains information about the following topics:

- message codes
- troubleshooting
- technical support
- returning instruments for repair

Please read this chapter; some problems may be easily resolved by using the information found in the message code and troubleshooting guides.

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Message Code Guide

The MICROLAB's display windows provide you with system status and with error message information.

If an error occurs, an error message appears, the system beeps three times, and all operation and function keys are disabled. To recover from the error, reinitialize the system by pressing the Run/Stop key. You cannot use the probe button on a hand probe to reinitialize the system.

Table 5-1 lists the messages that may appear in the message display windows.

Table 5–1 Message Code Guide

Left Side Display	Right Side Display	Meaning/Action
Size?	Size?	This message appears before initialization. By default, the size prompt appears in the left display panel. The system is prompting you to enter a syringe size. If you are using a single syringe unit, enter the syringe size. If you are using a dual syringe unit, enter the size of the left syringe, or press the right syringe size selection control to enter a size for the right syringe.
Spd xx	Spd xx	The system displays the current default speed setting, where "xx" represents a speed from 2 to 20.
Unit	Paused	This message appears when the Run/Stop key or the probe button is pressed during an operation to pause the instrument. The prime switch is inactive when the unit is paused.

continued

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Table 5–1 Message Code Guide *(continued)*

Left Side Display	Right Side Display	Meaning/Action
Syr	Stall	This message appears only on single-syringe units. The syringe is stalled.
R. Syr	Stall	This message appears only on dual-syringe units. The right syringe is stalled.
L. Syr	Stall	This message appears only on dual-syringe units. The left syringe is stalled.
Val	Stall	This message appears only on single-syringe units. The valve is stalled.
R. Val	Stall	This message appears only on dual-syringe units. The right valve is stalled.
L. Val	Stall	This message appears only on dual-syringe units. The left valve is stalled.
Over	Temp	The unit is overheated. Power off the unit and allow it to cool down. Check for the reason—is ventilation adequate? Is the room temperature appropriate? See Appendix A, Technical Specifications, for information about appropriate environmental conditions. Resume use at a lower duty cycle.

continued

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Table 5–1 Message Code Guide *(continued)*

Left Side Display	Right Side Display	Meaning/Action
Priming	Priming	The unit is in prime or step mode. This message is displayed until the mode is stopped.
Exceeds	Volume	The specified volume exceeds the capacity of the syringe. Enter a new volume that is within the capacity of the syringe.

Audible Messages

When a MICROLAB 500 system is operated via the controller unit, the system will provide audible messages—beeps, that indicate certain events. These events are listed in Table 5–2.

Table 5–2 Audible System Messages

Number of Beeps	Event
2	The system beeps twice upon power-up (at the end of power-up diagnostics).
1	The system beeps once at the start of an operation.
3	The system beeps three times if an error occurs.

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Troubleshooting Guide

Table 5-3 provides quick answers to help you troubleshoot your MICROLAB 500.

Table 5–3 Troubleshooting Guide

Problem	Possible Causes	Corrective Action
instrument does not power-up	• disconnected power cord or faulty power outlet	• connect power cord and check power source
	• main fuse is blown	• check main fuse on instrument's rear panel; replace fuse if necessary
instrument functions normally, but indicators or message display windows fail to illuminate	• faulty LED or LCD	• check to see that the controller unit is plugged into the drive unit • call the Hamilton Service Department
keys are non-functional	• instrument is in pause mode	• if `Unit Paused` appears in the display windows, press the Run/Stop key to finish the stroke
valve or syringe is stalled	• internal fault	• if a `Stall` message appears in the display windows, reinitialize the system by pressing the Run/Stop switch • if message persists, call the Hamilton Service Department

(continued)

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Table 5–3 Troubleshooting Guide *(continued)*

Problem	Possible Causes	Corrective Action
instrument does not fill or dispense	• faulty or blocked tubing; blocked or leaky fluid path	• check tubing, valve, and syringes for blockages, crimps, or loose fittings; replace tubing; either replace or reseal valve and syringes; tighten valve and syringes
	• incorrect tubing or syringe connections	• check that appropriate tubing, fittings, and syringes are used and that they are finger-tight
	• faulty keys	• call the Hamilton Service Department
	• non-functional syringe drive(s)	• call the Hamilton Service Department
	• valves do not rotate (valve drives are not engaged or valve is faulty)	• remove and reseat valve; tighten thumbscrew; or replace valve

(continued)

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Table 5–3 Troubleshooting Guide *(continued)*

Problem	Possible Causes	Corrective Action
instrument gives inaccurate or imprecise results	• air exists in the fluid path	• check to see that tubing ends are totally submerged in reagent bottles • check to see that tubing connections are tight; replace if necessary • check to see that the syringe is installed correctly and that it is not leaking • replace worn or leaking valve or tubing • reduce the syringe drive speed to eliminate cavitation problems
	• incorrect size of dispense tubing used with syringe	• check for correct tubing and fittings • use small tapered tubing (18-gauge) for small dispense volumes
small air gap appears at tip of probe tubing after final aspiration	• dirty tubing • improper aspiration	• change or clean the tubing • lower the aspiration speed

(continued)

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Table 5–3 Troubleshooting Guide *(continued)*

Problem	Possible Causes	Corrective Action
persistent air or leaks in the fluid path	• cavitation is occurring; syringe drive speed is too high for the current liquid	• reduce syringe drive speed, use lower drive speeds for viscous liquids
	• loose, worn, or incorrect tubing fittings	• hand-tighten the fittings or replace old tubing with new or correct-size tubing
	• damaged syringe plunger tip	• replace plunger tip or syringe
	• damaged valve	• replace valve
unit is overheated	• inadequate ventilation, room temperature too high, or duty cycle too high	• the unit is overheated, power it off and allow it to cool down • resume use at a lower duty cycle • see Appendix A, Technical Specifications, for information about appropriate environmental conditions

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Getting Technical Support

If a problem persists even after you have attempted to correct it, contact the Hamilton Company Instrument Service Department. To expedite service, please have your instrument's model and serial number ready and available. Also, please provide application-specific information (such as syringe sizes, drive speeds, and liquids).

In the United States:

Hamilton Company, P.O. Box 10030, Reno, Nevada 89520–0012
Telephone Numbers (in the USA and Canada):
Technical / Customer Service +1–800–648–5950 8 a.m. to 5 p.m. PST
Instrument Service +1–800–527–5269

Outside the USA and Canada:
+1–775–858–3000
Fax Number: +1–775–856–7259

In Switzerland:

Hamilton Bonaduz AG, Ch–7402, P.O. Box 26,
Bonaduz, Switzerland
Telephone Number: +41–81–660–60–60
Fax Number: +41–81–660–60–70

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Returning Instruments for Repair

Before returning an instrument to Hamilton (Reno) for repair, notify Hamilton Company's Instrument Service Department at (800) 527–5269 (in the United States and Canada) and request a Returned Goods Authorization Number (RGA number).

✶ **Note: Do not return instruments to Hamilton Company without an RGA number. This number assures proper tracking of your instrument. Instruments that are returned without an RGA number will be sent back to the customer without being repaired.** ✶

▲ **Important** **Decontaminate the instrument and remove health hazards, such as radiation, infectious diseases, corrosive agents, etc. Provide a complete description of any hazardous materials that have been used with the instrument.** ▲

▲ **Important** **Hamilton Company reserves the right to refuse a return shipment of any Hamilton product that has been used with radioactive or microbiological substances or any other material that could be hazardous to Hamilton employees.** ▲

▲ **Important** **Do not return syringes, tubing, or valves with your instrument. Hamilton Company will assume that they pose a health hazard, and will destroy them.** ▲

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Appendixes

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Appendix A Technical Specifications for the MICROLAB 500

Appendix A contains the technical specifications for MICROLAB 500.

Table A–1 Technical Specifications for the MICROLAB 500

Reagent / Diluent Syringe	25 µL to 25 mL (TLL- or TLLX-type)
Reagent / Diluent Volume Range	1 µL–25,000 µL
Sample Syringe	25 µL to 1 mL (DX-type)
Sample Volume Range	1 µL–1,000 µL
Accuracy and Precision*	See Table A-2
Resolution	.1% of syringe drive
Volume Increments	.1% of total syringe volume; adjustable
Speed**	2 to 20 seconds per full syringe stroke; adjustable
Drive	High-precision lead screws driven by a highly efficient stepper motor
Power Requirements	115 / 220 V; 50 / 60 Hz (power supply automatically converts)
Power Rating	150 VA
Weight	10 lbs., 6 oz (4.7 kg)
Dimensions	Height: 13 1 / 8 in (33.34 cm) Width: 6 1 / 8 in (15.56 cm) Depth: 7 in (17.78 cm)

continued

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Table A–1 Technical Specifications *(continued)*

Shipping Dimensions	Height: 14 1/4 in Width: 21 in Depth: 14 1/2 in
Shipping Weight	20 lbs.
Storage Temperature Range	-20° to 50 °C, -4° to 122 °F
Operating Temperature Range	5° to 40 °C, 41° to 104 °F
Recommended Operating Temperature Range	18° to 25 °C, 64° to 77 °F
Humidity Range	10%–90%, non-condensing
Fluid Path	PTFE-based materials and Borosilicate glass

**Use slower drive speeds and 12-gauge tubing with larger syringes, larger volumes (greater than or equal to 10 mL), and with viscous or volatile fluids. Syringe sizes of 250 µL to 5 mL may be run at speed 1.

Hamilton Company reserves the right to alter technical specifications without notice.

Table A–2 contains specifications for syringe accuracy and precision. This information is on file at Hamilton Company in Reno, Nevada.

Table A–2 Accuracy and Precision*

1 mL of Deionized Water at 23 °C		
Percent Stroke (%)	**Accuracy (+/-%)**	**Precision**
1%	3%	1.5%
5%	1.2%	.5%
30%	1.0%	.2%

*Best reproducibility and accuracy are achieved at syringe stroke lengths equal to or greater than 10% of syringe volume using Hamilton syringes. Liquid handling performance may vary according to viscosity, temperature, and technique.

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Appendix B Instrument Performance Test Reports

All instruments are subjected to quality control performance testing before they leave Hamilton Company. Each MICROLAB 500 system is shipped with a copy of its own performance test report. The report contains the actual results of a gravimetric test conducted on the instrument by Hamilton Company's Quality Control Department.

Keep your MICROLAB 500's performance test report for use as a benchmark of its original precision and accuracy. You may wish to periodically test your MICROLAB 500 and compare its current performance with its out-of-box-performance. Remember, when you test an instrument, you must test it under the same conditions it was originally subjected to. See your MICROLAB 500's own performance test report for specific details.

✶ **Note: When preparing to test a MICROLAB 500 system, do not include the first shot dispensed after system initialization as part of the performance test. Discard the first dispensed shot, then start the performance test.** ✶

Figure B–1 shows a sample performance test report.

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Figure B–1 Sample Performance Test Report

PERFORMANCE TEST REPORT

Test PASSES

GRAVIMETRIC RESULTS FOR 50 Microliters

Balance: Sartorius Model: R-160-P

Product/Model:ML/501A Part No. : xxxxx

Serial NO. : xx-xxxxxxxx DRIVE: SINGLE

Syringe Type: 1001

Syringe Maximum Volume: 1000 Microliters

Syringe Dispense Volume: 50 Microliters

Test Method: Dispenser ✓ Diluter _____

Liquid Type: H20 Liquid Temperature in Centigrade: 22

Rel. liquid density at Exper. Temp. : .997801 mg/microliters

Actual Measurements in milligrams

1.	49.93	mg	2.	50.00	mg
3.	49.95	mg	4.	49.89	mg
5.	49.91	mg	6.	49.83	mg
7.	49.91	mg	8.	49.81	mg
9.	49.88	mg	10.	49.83	mg

RESULTS

Mean Mass: 49.894 mg Standard Deviation: 5.929153E-02 mg

Experimental Vol.= 50.00396 microliters

Parameter	Calculated	Specification	Pass/Fail
Accuracy in %	0.008	1.200	PASS
Co of Var in %	0.119	0.500	PASS

Checked by: MARIA Date: 12/13/93

Signed: Maria Doe

The product specified above has been calibrated at ambient pressure. The calibration is performed pursuant to ML-STD-45662, with an unbroken chain of calibrations traceable to N.I.S.T.

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Appendix C Ordering Parts and Accessories for the MICROLAB 500

Appendix C contains information about ordering parts and accessories for MICROLAB 500 systems.

Table C–1 Reagent/Diluent Syringe Replacement Parts

Syringe Size	Part #	Description	Barrel	Plunger Tip	Plunger Assy. w/o Stop	Plunger Stop	Plunger Tip O-ring
25 µL	80222	1702TLLX Syringe	10280	N / A	13269	N / A	N / A
50 µL	80922	1705TLLX Syringe	10222	N / A	1117-01	N / A	N / A
100 µL	81022	1710TLLX Syringe	10223	N / A	1117-02	N / A	N / A
250 µL	81122	1725TLLX Syringe	10339	N / A	1117-03	N / A	N / A
500 µL	81222	1750TLLX Syringe	10340	N / A	1120-01	N / A	N / A
1.0 mL	81323	1001TLLX Syringe	10341	N / A	1578-01	N / A	N / A
2.5 mL	81420	1002TLL Syringe	10227	N / A	1360-01	N / A	N / A
5.0 mL	81520	1005TLL Syringe	10203	13430	13230	N / A	16114
10.0 mL	81620	1010TLL Syringe	10204	13431	13231	N / A	16104
25.0 mL	82521	1025TLL Syringe	10448	N / A	13271	N / A	N / A

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Table C–2 Sample Syringe Replacement Parts

Syringe Size	Part #	Desc.	Barrel	Plunger Tip	Plunger Assy. w/o Stop	Plunger Stop	Plunger Assembly	Plunger Tip O-ring
25 µL	80226	1702DX Syringe	10436	N / A	13269	N / A	N / A	N / A
50 µL	80926	1705DX Syringe	10437	N / A	1117-01	N / A	N / A	N / A
100 µL	81026	1710DX Syringe	10438	N / A	1117-02	N / A	N / A	N / A
250 µL	81126	1725DX Syringe	10439	N / A	1117-03	N / A	N / A	N / A
500 µL	81226	1750DX Syringe	10440	N / A	1120-01	N / A	N / A	N / A
1.0 mL	81326	1001DX Syringe	10441	N / A	1578-01	N / A	N / A	N / A

Table C–3 Valve Assemblies

Part Number	Description
35825	HV Valve (Model 501A)
35844	Diluter Valve (Model 503A)
35842	Dispenser Valve (Model 504A)

Table C–4 Tubing

Part Number	Description
240000	Fill tubing: 12-gauge 650 mm with Fittings
240010	Fill tubing: 18-gauge 650 mm with Fittings
240360	Dispense tubing: 12-gauge 900 mm with Fittings
240130	Dispense tubing: 18-gauge 900 mm with Fittings

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Table C–5 Pipettors/Probes

Part Number	Description
35529	Concorde Push-button Hand Pipettor / Probe, Single Channel
35767	Dual Dispense Push-button Hand Pipettor / Probe
77006	Disposable Tip Push-button Hand Pipettor / Probe, 22-gauge x 900 mm tubing, 1–35 µL
77007	Disposable Tip Push-button Hand Pipettor / Probe, 22-gauge x 900 mm tubing, 1–125 µL
35899	Luer Lock Tip Push-button Hand Pipettor / Probe
35898	Viscous Sample Push Button Hand Pipettor / Probe
35770	Tubing Reducer, 18 gauge, for Dual Dispense Push-button Hand Pipettor / Probe (1 each)
77004	Footswitch

Table C–6 Parts and Accessories

Part Number	Description
39111	Reagent Bottle Holder
35783	Accessory Holder, also known as a MICROLAB Probe Accessory Bracket (needed with reagent bottle holder)
16500	Screw, 4–40 x 7/8 (two required to attach bracket)
88990	Tubing Clips (5-pack)
18310	Hamilton Syringe Cleaning Solution 70 cc
18311	Hamilton Syringe Cleaning Solution 500 cc
1524-01	Fuse, Slow Blow, 1 amp
6541000	Power Cord, 115 V, Three-prong, Grounded
355010	Power Cord, 220 V, Schuko

continued

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Table C–6 Parts and Accessories *(continued)*

Part Number	Description
69175	*MICROLAB 501A, 503A, 504A User's Manual* (English version)
69181	*MICROLAB 501A, 503A, 504A User's Manual* (French version)
69179	*MICROLAB 501A, 503A, 504A User's Manual* (German version)
69185	*MICROLAB 501A, 503A, 504A User's Manual* (Portuguese version)
69187	*MICROLAB 501A, 503A, 504A User's Manual* (Spanish version)

For more information about ordering parts and accessories, or upgrading your MICROLAB 500 system, contact your authorized Hamilton dealer or the Hamilton Company:

In the United States:

Hamilton Company, P.O. Box 10030, Reno, Nevada 89520–0012
Telephone Numbers (in the USA and Canada):
Technical / Customer Service +1–800–648–5950 8 a.m. to 5 p.m. PST
Instrument Service +1–800–527–5269

Outside the USA and Canada:
+1–775–858–3000
Fax Number: +1–775–856–7259

In Switzerland:

Hamilton Bonaduz AG, Ch–7402, P.O. Box 26,
Bonaduz, Switzerland
Telephone Number: +41–81–660–60–60
Fax Number: +41–81–660–60–70

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Appendix D Chemical Compatibility of the MICROLAB 500

The following table contains information about chemical reactivity with the MICROLAB 500 system.

Legend

– = No data available

0 = No effect, excellent

1 = Minor effect, good

2 = Moderate effect, fair

3 = Severe effect, not recommended

Table D–1 Chemical Compatibility

Solvent	PTFE	Kel F
Acetaldehyde	0	0
Acetates	0	0
Acetic Acid	0	0
Acetic Anhydride	0	0
Acetone	0	0
Acetyl Bromide	0	–
Ammonia	0	0
Ammonium Hydroxide	0	0
Ammonium Phosphate	0	0
Ammonium Sulfate	0	0
Amyl Acetate	0	1

continued

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Table D–1 Chemical Compatibility *(continued)*

Solvent	PTFE	Kel F
Aniline	0	0
Benzene	0	2
Benzyl Alcohol	0	0
Boric Acid	0	0
Bromine	0	0
Butyl Alcohol	0	0
Butyl Acetate	0	2
Carbon Sulfide	0	0
Carbon Tetrachloride	0	1
Chloracetic Acid	0	0
Chlorine	0	1
Chlorobenzene	0	1
Chloroform	0	1
Chromic Acid	0	0
Cresol	0	1
Cyclohexane	0	1
Ethers	0	1
Ethyl Acetate	0	2
Ethyl Alcohol	0	–
Ethyl Chromide	0	1
Formaldehyde	0	0
Formic Acid	0	0

continued

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Table D–1 Chemical Compatibility *(continued)*

Solvent	PTFE	Kel F
Freon	0	1
Gasoline	0	0
Glycerin	0	0
Hydrochloric Acid	0	0
Hydrochloric Acid (conc)	0	0
Hydrofluoric Acid	0	0
Hydrogen Peroxide	0	0
Hydrogen Peroxide (conc)	0	0
Hydrogen Sulfide	0	1
Kerosene	0	0
Methyl Ethyl Ketone (MEK)	0	1
Methyl Alcohol	0	1
Methylene Chloride	0	1
Naphtha	0	0
Nitric Acid	0	0
Nitric Acid (conc)	0	1
Nitrobenzene	0	1
Phenol	0	–
Pyridine	0	1
Silver Nitrate	0	1
Soap Solutions	0	0
Stearic Acid	0	–

continued

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Table D–1 Chemical Compatibility *(continued)*

Solvent	PTFE	Kel F
Sulfuric Acid	0	0
Sulfuric Acid (conc)	0	0
Sulfurous Acid	0	1
Tannic Acid	0	1
Tanning Extracts	–	–
Tartaric Acid	0	1
Toluene	0	1
Triclorethylene	0	3
Turpentine	0	0
Water	0	0
Xylene	0	2

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Glossary

active valve
A valve that allows for diversion of liquid flow from the input side to a syringe, and from a syringe to the output side.

air gap
A segment of air that is aspirated through the probe, used to separate different liquids in the tubing lines.

aspirate
To pick up a designated volume of sample or air through a pipette or a probe tip.

Auto-Refill
In this operation, the drive arm moves down after fluid is dispensed to automatically refill syringes.

cavitation
An occurrence caused by applying a high vacuum to a liquid (gas dissolved in liquid can be pulled out of solution). It generally occurs when large syringes (5 and 10 mL) are driven at high speeds.

Concorde hand probe
The Concorde hand probe is Hamilton Company's standard single hand-activated probe. The tip of this probe is adjustable and allows the user to set the dispense tubing to an angle that is comfortable for use.

control indicators
LEDs that show the active function on the controller unit.

controller unit
The device that allows the user to send operating instructions to the drive unit.

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cycle
A series of two strokes that comprise both the up and down movements of the syringe drive arm.

Decrease key
A control used to decrease the settings for syringe sizes, volumes, or speeds.

default
A predetermined value in a program or in computer circuitry that an operator may or may not alter.

diluent
A liquid that is added to a sample to lessen the sample's concentration (i.e., to dilute the sample).

diluent syringe
A syringe that delivers a diluent. On a dual syringe unit, the diluent syringe is usually the syringe on the left.

dilute
To reduce the concentration of solutes in a sample by adding another fluid. The fluid that is added is called a "diluent" and may be deionized water, for example.

diluter
An instrument used to reduce the concentration of a liquid. The MICROLAB 503A is a dual syringe diluter.

dispense
To distribute fluid in a single portion or in several increments. A diluent is dispensed during dilution. Reagents and buffers can be mixed and dispensed together with a sample before analysis.

dispense tubing
Tapered tubing that is attached to a hand or foot probe to deliver precise amounts of liquid.

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dispenser
An instrument used to distribute liquid. The MICROLAB 501A is a single syringe dispenser. The MICROLAB 504A is a dual syringe dispenser.

disposable tip
A throw-away probe tip used to avoid cross-contamination between samples.

display windows
The two areas on the controller unit where system messages and information appear. Synonymous with *message display windows.*

Down
Describes the movement of the syringe drive arm as it moves away from the Home position and stops at the bottom of the downward stroke.

dribbling
Describes the formation of drops at the tip of tubing as liquids are dispensed. Generally occurs when small volumes are dispensed at low flow rates or when there is an air leak in the tubing lines. Drop formation can adversely affect accuracy and precision.

drive speed
Speed of the drive unit; speed is specified in seconds per full stroke. Drive arm speeds are measured in units from 2 to 20, with 2 being the fastest speed and 20 being the slowest speed.

drive unit
The basic body of the MICROLAB 500. Contains the electrical connectors and the syringe drive arms.

dual dispenser
A two-syringe instrument that can dispense two different liquids at the same time. The volumes of the liquids being dispensed do not have to be equal. The MICROLAB 504A is a dual syringe dispenser.

duty cycle
The amount of time that an instrument is active and functioning versus the amount of time it is inactive or idle.

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fill
To fill a syringe with a volume of liquid that is pulled in from a reservoir via fill tubing. Drive arms move the syringes down, pulling liquid up through the tubing and into the syringe.

fill tubing
A tubing line that connects the liquid reservoir to the inlet valve port.

fluid path
The inside surfaces of the valve, syringes, and tubing that contact liquid.

footswitch
A foot-activated device used to operate the MICROLAB 500.

hand probe
See probe

Home position
The position of the syringe drive arms when they are at the top of their range of movement.

inactive valve
A valve with one fixed flow passage; it cannot be used for liquid distribution.

Increase key
A control used to increase the syringe size, volume, or speed settings.

initialize
To establish the basic conditions for starting an operation.

LED
Light **E**mitting **D**iode used for indicator lights on the MICROLAB 500.

luer fitting
The standard “twist and lock” type of fitting..

message display windows
The two areas on the controller unit where system messages and information appear.

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MICROLAB 501A
Hamilton Company's single syringe dispenser.

MICROLAB 503A
Hamilton Company's dual syringe diluter/dispenser.

MICROLAB 504A
Hamilton Company's dual syringe dispenser.

operation
The Up, Down, Auto-Refill, or Prime functions performed by the MICROLAB 500 systems.

operation indicator lights
LED lights that show the current functions being performed by a MICROLAB 500 system.

operation keys
The Up, Down, and Auto-Refill images on a MICROLAB 500 controller unit. Each image represents a function; press on the image to activate the function.

overload
A stall in syringe plunger movement that may be caused by excess mechanical friction, excess syringe speed, or a blockage in the valves, tubing or syringes.

pipette
To measure a fixed amount of liquid with a probe.

power-down
To turn off an electrical device.

Power Indicator light
A LED on the drive unit that shows whether or not the MICROLAB system is powered on.

Power On/Off switch
A switch used to turn the MICROLAB system on.

power-on
To turn on an electrical device.

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prime
To make an instrument ready for operation by running fluid through the tubing lines of an instrument to ensure that neither bubbles nor air gaps exist in the tubing lines. You must prime the system prior to use and between fluid changes.

prime mode
The process of priming an instrument.

probe
A hand-held device that contains dispense tubing. Each probe also has a button that can be used to control the drive unit.

reagent/diluent syringes
Syringes that pick up and dispense reagent and diluent. The GASTIGHT TLL-type and TLLX-type syringes are reagent / diluent syringes.

reservoir
A container that holds system fluid (diluent).

Returned Goods Authorization Number (RGA#)
A number, assigned by the Hamilton Company, that is used to trace your instrument in the event it is returned for repair.

Run/Stop key
A control used to start, stop, or pause an operation on the MICROLAB 500.

sample syringe
A syringe used to pick up a liquid sample. GASTIGHT "D" configuration syringes with side ports are sample syringes. On a dual syringe unit, the sample syringe is usually placed on the instrument's right side.

Speed key
A key located on the controller unit used to select the speed function.

step
Movement of the drive arms that occurs when the Step / Prime switch is held down. The Step mode is often used to position the drive arm before changing syringes.

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stroke
Full movement of the syringe drive arm in one direction only; half of the drive arm's cycle. *See also* cycle.

syringe drive arm(s)
The arms to which syringes connect. The movement of the syringe drive arms displaces fluid, drawing it through the system.

Syringe Size key
A key located on the controller unit used to select the syringe size function.

system fluid
Refers to the fluid originating from a reservoir, pumped through the entire system.

tubing clip
A device that attaches to the side of the reservoir and holds tubing lines in place.

Up
The function that moves the syringe drive arms to the Home position.

valve
The device that directs the flow of liquid through the system.

valve port
Openings in the valve assembly through which liquid flows. As the valve turns, ports are opened or closed, directing the flow of liquid through the system.

Volume key
A key located on the controller unit used to select the syringe volume function.

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