*Well*Mate™

Manual

Matrix Technologies Corp.
22 Friars Drive
Hudson, NH 03051, USA
Toll-free: (800) 345 0206
www.matrixtechcorp.com

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A. Introduction

The WellMate instrument from Matrix Technologies is a high-speed, small footprint, 8-channel fluid dispenser for 96- and 384-well microplates. It repetitively dispenses samples and reagents into the plates, with high accuracy and efficiency.

You can program the WellMate unit with dispensing protocols, setting dispense volumes, plate type, and more.

Features and applications of the WellMate instrument include:

- Height-adjustable dispense head that accommodates shallow- and deep-well plates and blocks
- High-resolution, stepper-motor technology that allows fast, accurate dispensing
- Low-cost, replaceable tubing cartridges
- Dynamic dispense volume range (2.0µL–2000µL), programmable in 1.0µL increments
- Easy programming that allows you to select individual plate columns for dispense
- Memory-storage capacity for 18 files
- Full RS-232 programming for ease of integration
- Removable plate stage that allows easy cleaning of the Teflon coated base

B. Instrument Overview

1. General Description

The WellMate instrument dispenses samples and reagents efficiently through use of a peristaltic pump mechanism and a unique, disposable tubing cartridge. Operators can adjust nozzle height to customize use of the instrument for different plate configurations (for example, flat-bottom plates or V-bottom plates).

Your WellMate instrument package provides these items:

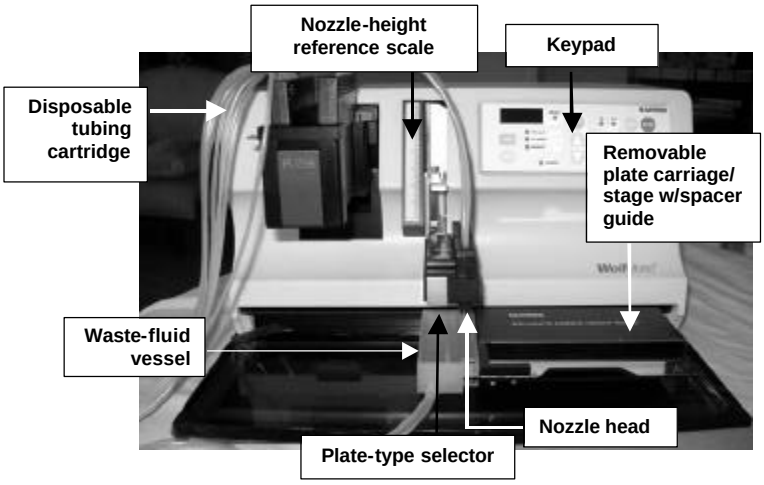
- Base unit
- AC power cord
- Two disposable 8-channel tube assemblies, with silicone-based tubing and polypropylene nozzles. One each of:
    - Standard-bore tubing cartridge, for use with 96-well (shallow or deep well) microplates.
        - Nozzle orifice ID 0.023in (0.58mm).
        - Dispenses volumes 20–2000µL.
        - Applications include sterile plate filling and dispensing of cellular materials, viscous fluids, and beads.
        - To order replacement 5-pack, use item no. 201-30001.
    - Small-bore tubing cartridge, for use with 96- and 384-well (shallow or deep well) microplates.
        - Nozzle orifice ID 0.015in (0.38mm).
        - Dispenses volumes 2–200µL.
        - Applications include sterile plate filling, dispensing of high vapor pressure fluids, and dispensing of small volumes (2–200µL) with enhanced precision.
        - To order replacement 5-pack, use item no. 201-30002.
- Nozzle-height reference scale

- Nozzle-height spacer guide
- 7/64-inch Allen wrench (for use in tubing-cartridge adjustment)
- Universal-microplate removable stage
- Waste-fluid vessel with tubing

The customer must provide:

- Container for liquid intended for dispensing
- Liquid vessels (96- or 384-well SBS-format microplates)
- RS-232 Dsub connection cable if you wish to control the instrument from a remote device (To order: Matrix item number 501-30019)
- Bottle to contain drained waste fluid from waste-fluid vessel

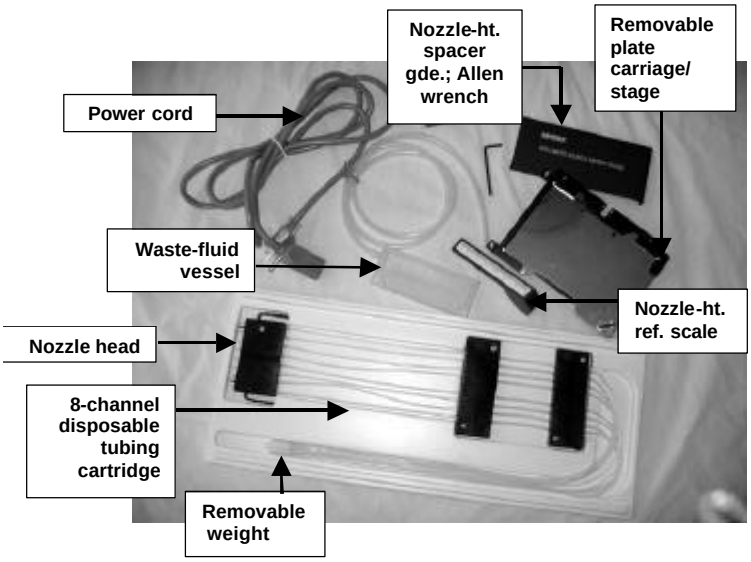
The WellMate instrument appears in the following figure.



The components shown in the following figure are provided with the WellMate base unit.

Note: Only one disposable tubing cartridge appears in the following photograph. Note, however, that **two** disposable tubing

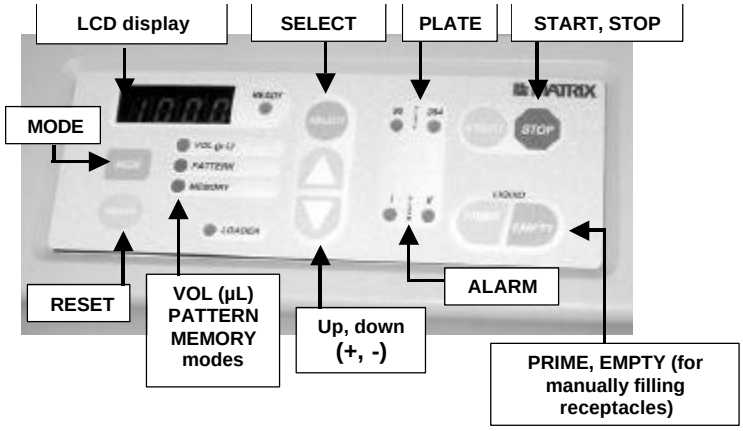
cartridges, one each of the standard-bore tubing and the small-bore tubing, are included in the initial system package.



2. Keypad and LCD Display

The keypad allows the operator to program and execute dispense operations. You can also execute "manual operations" (that is, without using a preprogrammed dispense volume) by pressing and releasing the PRIME and EMPTY keys on the keypad.

Instructions for using the keypad are described under "Prime Tubing Cartridge; Create Programs; Operate Instrument" beginning on page 18.



Key and Display Description (clockwise from top left)

LCD display—Displays volume, selected channel, program number, and error-message codes.

SELECT—When PATTERN mode is selected, allows you to cycle through channels (individual tubes) to toggle them on or off for dispense. When MEMORY mode is selected, allows you to first load and then save a program in memory.

Plate type LEDs—Indicates which plate type—96-well or 384-well—is currently selected.

START and STOP—Allows you to start and stop the run of a program. Also, you press STOP to stop the program when an error occurs and an alarm sounds. After you press STOP,

the operation (dispense) of the currently selected channel will finish and then the operation will end.

PRIME and EMPTY—Allow you to manually aspirate supply agents into channel tubing (PRIME) or manually dispense agents currently in the channel tubing (EMPTY). You must press and hold the key for as long as you want the fill or empty operation to continue.

Alarm—LED lights up when error occurs; audio signal also sounds and LED display shows error code.

Up and Down arrows—In VOL mode, allows you to increase or decrease dispense volume. In PATTERN mode, allows you to select or deselect individual channels for dispense. In MEMORY mode, allows you to choose a program number for a program.

VOL (mL)—Mode to set dispense volumes.

PATTERN—Mode to set columns (wells) to be filled in a dispense.

MEMORY—Mode to save a set of dispense volumes and selected dispense channels as one of 18 programs (nine for 96-well plates and nine for 384-well plates).

RESET—Allows you to restart a program after you have stopped the program run. When you press RESET, the stage returns to its starting position. Also, when the VOL mode is selected, you can press RESET to increment the dispense volume setting by 200µL at a time.

MODE—Allows you to select the three modes—VOL, PATTERN, and MEMORY—one at a time, to set a program's parameters.

3. Specifications

Table 1. Instrument Specifications

Power supply	AC 100–240V, 50/60Hz 40VA
Dimensions (hXwXd)	11X14.75*X 11.5 in. (27.94X37.47X29.21cm) (*Allow at least 3 more inches [7.62cm] in width for extension of tubing and ~6 more inches [15.24cm] in depth for extensions of power cord and waste-fluid tubing.)
Weight	24lbs (10.89kg)

Table 2. Standard-bore Tubing Cartridge Specifications (item no. 201-30001)

Description	8-channel, pre-sterilized, standard-bore disposable tubing cartridge. Inner diameter nozzle orifice = 0.023in (0.58mm).
Recommended dispense volumes	20µL to 2000µL
Recommended uses	With 96-well (shallow- or deep-well) plates, for • Sterile plate filling • Dispensing of volumes 20–2000µL • Dispensing of cellular materials • Dispensing of viscous fluids
Dispense accuracy/precision	+/-2.0% or 1.0µL
Precision limit	1000 96-well microplates processed with 100µL dispense volume

Table 3. Small-bore Tubing Cartridge Specifications (item no. 201-30002)

Description	8-channel, pre-sterilized, small-bore disposable tubing cartridge. Inner diameter nozzle orifice = 0.015in (0.38mm).
Recommended dispense volumes	2µL to 200µL
Recommended uses	With 96-well or 384-well (shallow- or deep-well) plates, for • Sterile plate filling • Enhanced dispense precision • Dispensing of high vapor pressure fluids
Dispense accuracy/precision	+/- 4.0% or 0.4µL < 20µl +/- 2.0% ≥ 20µl
Precision limit	1000 96-well microplates processed with 100µL dispense volume

4. Hazards/Precautions

Note the following hazards and precautions for setup, operation, and maintenance of the WellMate instrument:

Operator protection

- Always unplug the unit from the power outlet before you perform any service or maintenance task that does not require power.
- Do not touch nozzles or the stage when the unit is operating.

Base-unit protection

- Use only dilute detergent cleaning solutions to clean the unit. Do not clean the **keypad** with bleach solutions or other solvents. To clean the unit, first remove the tubing assembly from the instrument. Then use a bleach solution (2%) or an

aqueous-based cleaner to clean surfaces. Rinse solution completely from surface.

- If liquid leaks out of the tubing onto the stage or onto any other part of the instrument, stop the operation immediately and then wipe off the liquid.

Tubing-cartridge protection

- Inspect the nozzles and nozzle tips regularly to ensure that the tips are not clogged and that there is no debris in the nozzles. Clean them regularly following the procedures described on page 26.
- Be careful not to bend the nozzles.

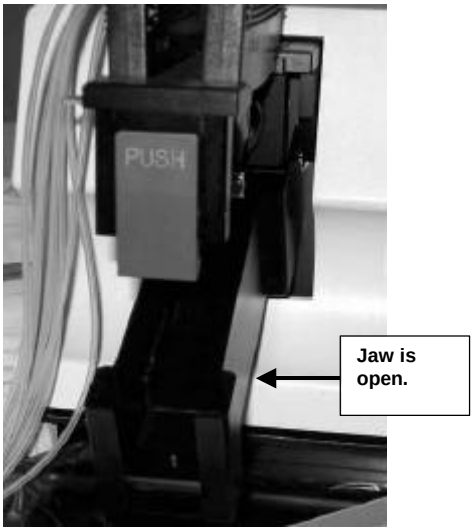
C. Configuring the Device

1. Install the Tubing Cartridge

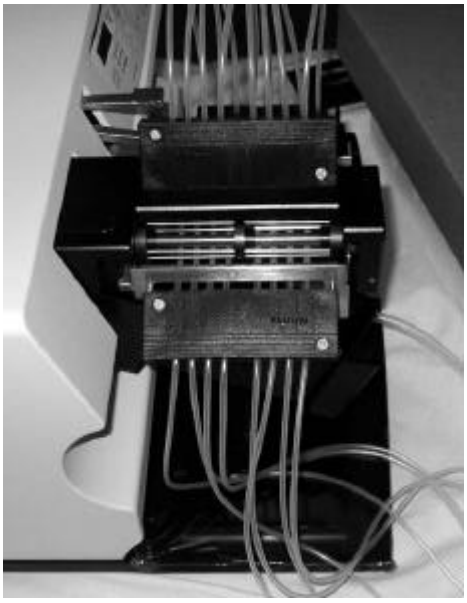
To install a tubing cartridge:

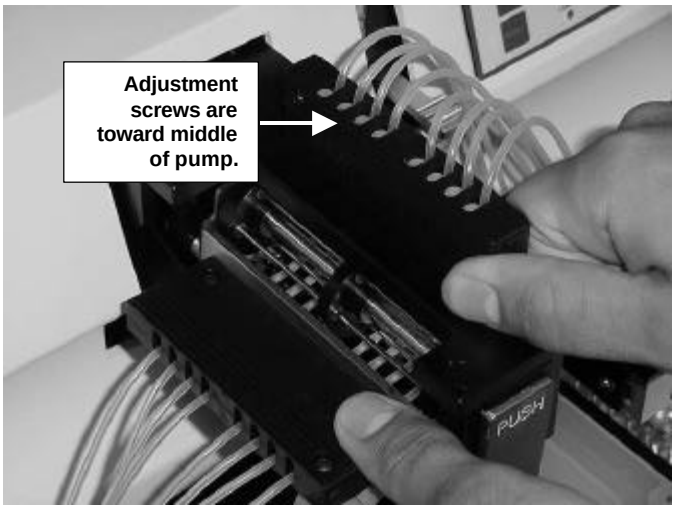
1. When installing the tube set, make sure that the adjustment screws are accessible. To do this, have the screws on the top half when you lay out the tube set so the adjustment screws will be toward the middle of the pump when presented on the machine.

2. Push the blue Push button on the front of the tube holder to open the mechanism.



3. When installing the tubing, place the left-hand tube holder onto the arm first. Then place the other holder into position. Rotate the arm so the tubing is set into position.



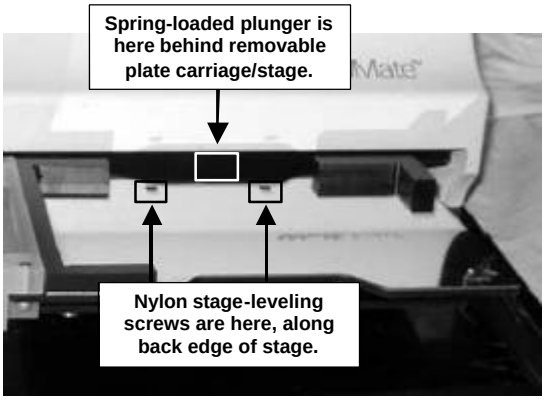


4. Push the cover on the pump mechanism to the closed position.

5. Insert the nozzle tip head as shown in the following:

2. Attach the Removable Plate Carriage/Stage

1. Tilt the plate carriage/stage so that its front edge is slightly higher than its back edge. Slide the notch in the plate carriage piece up under the spring-loaded plunger. Push the stage in gently and firmly until the two posts on either side of the back edge of the stage slide completely into the slots on the base unit. Move the stage manually to the end of its rightward movement.



2. If the stage is not level with the nozzle tips, first try pushing the stage toward the back of the unit to ensure that it is

pushed in completely. If it is still not level, slide the stage under the nozzle tips, and put a weight on the left (your left) side of the stage. Then use a flathead screwdriver to adjust the left nylon screw in the middle back of the stage, tightening the screw to push the stage down. Do the same with the right side of the stage, adjusting the right-hand nylon screw. Check visually to ensure that the distance between the stage top and the bottom of the front nozzle tip is equal to the distance between the stage top and the bottom of the back nozzle tip; that is, bottoms of nozzle tips and stage top are parallel from front to back.

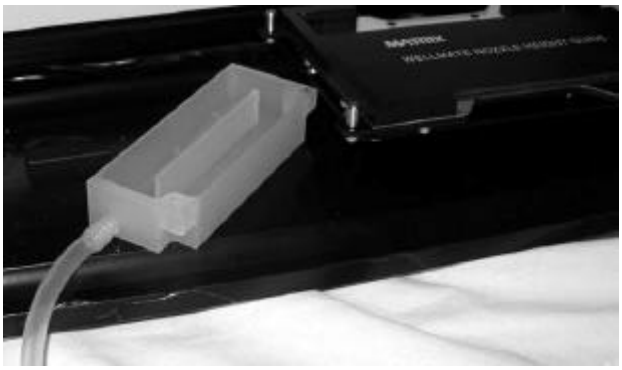
If you are using 384-well plates and the stage is not level with the nozzle tips, the nozzles might not be properly targeted with all the columns in the plate. Slide the stage left and right. Then use a flathead screwdriver to adjust the nylon screws as described above.

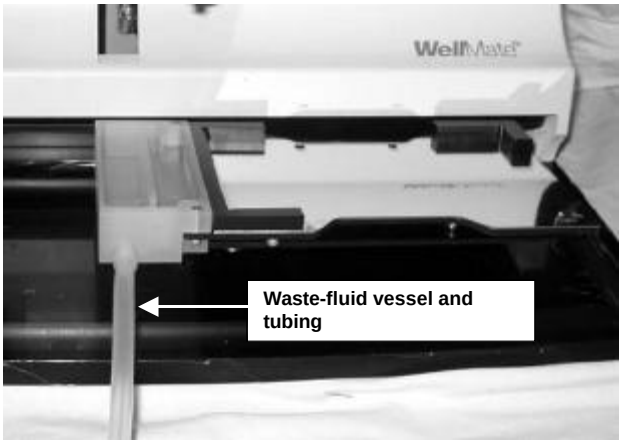
3. Attach the Waste-Fluid Vessel

Align the two holes on the top edge of the waste-fluid vessel over the posts extending upward from the flange on the left side of the plate carriage, and drop the waste-fluid vessel over the posts. Place the open end of the tube into a receptacle that sits below the surface of the instrument base.

CAUTION: Ensure that the open end of the tubing remains above any liquid in the receptacle; if it is immersed, the vessel will not drain properly.

The first of the following two photos shows the waste-fluid vessel detached from the plate carriage. It is very easy to remove and replace the vessel. The second photo shows the waste-fluid vessel in place next to the plate carriage.

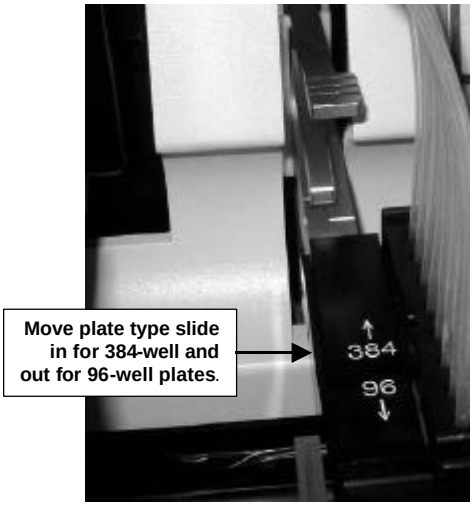




4. Set Up Plates

For each type of 96- or 384-well plate you will use, set up a sample plate as follows:

1. Set the plate type by moving the plate-type slide in toward the machine for 384-well plates and out away from the machine for 96-well plates.



2. Move the nozzle head down until it is just above the openings of the first column of wells in the plate. Visually check to see that the nozzle tips are centered in the wells. Check also to verify that the tips are not bent.

3. Raise the nozzle tips. Put the nozzle height spacer guide on top of the microplate and then push the lever on the nozzle tips arm down until the two black standoffs on the tip holder rest on top of the spacer guide. This sets an ideal nozzle height for dispensing.

4. **Optional**: Peel the covering off the adhesive tape on the back of the nozzle-height reference scale and attach it to the instrument, to the left of the plate-type lever. When you have

set the tips for a particular plate to the height you want to dispense from, mark the reference scale for that plate and height.

5. Attach the Power Cord

Plug the power cord into the power-cord receptacle on the back of the unit.


O
COM1
COM2

D. Prime Tubing Cartridge; Create Programs; Operate Instrument; Adjust Stage Position or Dispensing Speed

Turn the instrument on by pressing the power switch on the back of the instrument to ON.

You will need to prime the tubing cartridge whenever you install a different cartridge on the instrument.

Note: The tubing cartridge is already calibrated when you receive it; you do not need to calibrate it.

You can then create, load and save programs and operate the instrument programmatically **OR** operate the instrument manually.You can also adjust tip-to-well alignment by adjusting the X-axis stage position and you can change the dispensing speed setting.

This section describes those priming, programming, operation and adjustment tasks.

1. Prime the Tubing Cartridge

Whenever you change the tubing cartridge, you will need to prime it. The first time you use the instrument, you will need to prime the tubing set.

To prime the tubing cartridge:

1. Put the supply ends of the channel tubes in a receptacle containing dH_2O or dispense medium.

2. Ensure that the waste-fluid vessel is below the dispensing end of the channel tube and that the open end of the waste-fluid tubing is in a receptacle, with the end of the tubing ABOVE any liquid in that receptacle.

3. Lower the nozzle tips so that they are at the correct dispensing height above the waste-fluid vessel or a plate on the stage.

4. Press and hold the **PRIME** key until a continuous flow moves through all the channel tubes.

2. Create, Load, and Save a Program in Memory

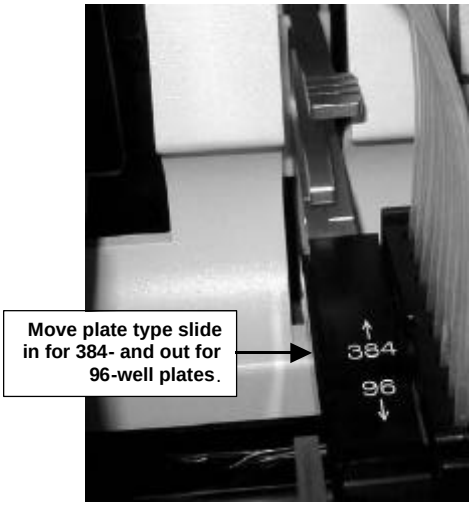
You can construct and save up to 18 programs (9 for 96-well plates and 9 for 384-well plates) programs that allow you to easily adjust dispense volume and column use.

To program a dispense sequence to fill a plate, you will:

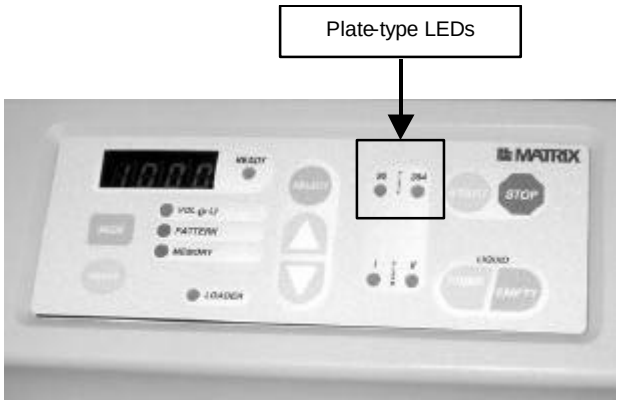
- Select a plate type (96 or 384).
- Set the dispense volume.
- Select columns (wells) to be filled in the dispense operation.
- Load the program into memory and save it.

1. Select the plate type.

   Set the plate type by moving the plate-type slide in toward the machine for 384-well plates and out away from the machine for 96-well plates.



Verify that the plate type LED for your plate (96 or 384) lights up on the keypad.



2. Set the dispense volume:

   Press **MODE**. The VOL (µL) LED lights up.

   Press the **up** and **down** arrows to increase or decrease volume (the current volume appears in the LED display).

   Note: To increase the dispense volume in increments of 200µL, press **RESET**.

3. Select the dispense pattern (which plate columns are to be filled):

   Press **MODE**. The PATTERN LED lights up. The two leftmost digits in the display show the column (for example, 01 for column 1). The third display digit, on the right of the display, is 0 or 1. A "0" indicates that this column is not selected to dispense; a "1" indicates that this column is selected to dispense.

   If you wish to change the current selection of the column use from on to off or off to on, press **SELECT**. The digit will be toggled to the other value, either 0 or 1.

   Press the **up** or **down** arrow to move to another column.

   Continue to press **SELECT** to toggle dispense on or off for each column.

4. Save the program:

   Press **MODE**. The MEMORY LED lights up.

   Press the **up** or **down** arrow to move to the program number you want to save this program to. If you are using a 96-well plate, program numbers 1–9 appear, one at a time, in the display. If you are using a 384-well plate, numbers 11–19 appear in the display.

   When the program number you want to use appears in the display, press **SELECT**. "LoAd" appears in the display. Press **SELECT** again. "SAVE" appears in the display.

   Press **START**. The dispense volume you set for this program shows in the display.

3. Run a Program From Memory

1. Ensure that the supply ends of the channel tubes are in the container with the agent to be dispensed.

2. Ensure that the waste-fluid vessel is in place and that the waste-fluid tube is placed in a waste liquid container, with the open tube end ABOVE any waste liquid in the container.

3. Put the plate in the plate carriage.

4. Verify that the READY light and the correct LED for your plate type are lit on the keypad.

5. Test that the nozzle-tips height is correct by using the nozzle-height guide.

6. Press the **MODE** key twice; the MEMORY LED is lit. Then select the program you want to run.

7. Press **SELECT**. Load appears in the LED display.

8. Press **START**. The program dispense volume appears in the LED display.

9. Press **START**. The program begins running.

10. Press **STOP** if you need to stop the program. Press **START** if you want to restart from the point where the program stopped; press **RESET** to restart the program from the beginning.

11. When you are finished with the dispensing operations, return the agent remaining in the tubes to the supply receptacle or other container. Then rinse the tubing first with water and then with alcohol to dry the tubing, or perform the appropriate cleaning action (see the maintenance information in the next section).

12. When you have finished using the instrument, leave the tubing in a resting position: fold open the left-hand side of the tubing assembly.

4. Operate the Instrument Manually

To operate the instrument manually:

1. Select the plate type.

   Set the plate type by moving the plate-type slide in toward the machine for 384-well plates and out away from the machine for 96-well plates.

   Verify that the plate type LED for your plate (96 or 384) lights up on the keypad.

2. Put a plate or other receptacle on the stage.

3. Adjust the nozzle height to the correct height by using the nozzle height spacer guide.

4. Set the dispense volume:

   Press **MODE**. The VOL (µL) LED lights up.

   Press the **up** and **down** arrows to increase or decrease volume (the current volume appears in the LED display).

   Note: To increase the dispense volume in increments of 200µL, press RESET.

5. Select the dispense pattern (which plate columns are to be filled):

   Press **MODE**. The PATTERN LED lights up. The two left-most digits in the display show the column (for example, 01 for column 1). The third display digit, on the right of the display, is 0 or 1. A “0” indicates that this column is not selected for dispense; a “1” indicates that this column is selected for dispense.

   If you wish to change the current selection of the column use from on to off or off to on, press **SELECT**. The digit will be toggled to the other value, either 0 or 1.

   Press the **up** or **down** arrow to move to another column.

   Continue to press **SELECT** to toggle dispense on or off for each column.

6. Press the **PRIME** key to draw the agent into the tubes and ensure that liquid flows freely through all tubing in a continuous flow.

7. When you are finished with the dispensing operations, press the **EMPTY** key to return the agent remaining in the tubes to the supply receptacle or other container. Then rinse the tubing first with water and then with alcohol to dry the tubing, or perform the appropriate cleaning action (see the maintenance information in the next section).

8. When you have finished using the instrument, leave the tubing in a resting position: fold open the left-hand side of the tubing assembly.

5. Adjust the X-Axis Stage Position

This feature allows the operator to "teach" the stage position for dispensing. Use this feature to fine-tune the desired plate position for dispensing to occur.

1. Put a 96-well plate on the stage. Select plate type **96** (on the nozzle holder) and then turn off the instrument.

2. Press the **START** and **STOP** keys simultaneously and turn on the instrument.

3. Press **START**. Verify that the plate type LED on the display and the plate selector are both set to plate type 96.

4. Press **START**. The stage will move automatically so that column 7 is under the nozzle tips.

5. Press the **up** and **down** arrow keys to adjust the stage position until the tips are aligned in the wells as you want them to be. (The LED display will show a volume range from –300 to +300.)

6. When you have finished adjusting the stage position for the 96-well plate, replace the 96-well plate with a 384-well plate. Press **RESET**. The stage will move automatically until column 13 is under the nozzle tips.

7. Press the **up** and **down** arrow keys to adjust the stage position until the tips are aligned with the wells as you want them to be.

8. When you have finished adjusting the stage position in the first set of the column 13 well positions, press **RESET**. The stage will move automatically until the second set of the column 13 well positions is under the nozzle tips.

9. Press the **up** and **down** arrow keys to adjust the stage position until the tips are aligned with the wells as you want them to be.

10. Press **RESET** when you have finished the adjustment and then turn off the instrument.

6. Adjust the Dispensing Speed

Please note, the tubing cartridge specifications are set using the highest speed (S-1)

1. Press the **PRIME** and **EMPTY** keys simultaneously and turn on the instrument.

2. Press **SELECT** to cycle through the three pump-speed choices as they appear in the LED display. The choices are

   S-1 = High speed (This is the normal setting.)

   S-2 = Medium speed

   S-3 = Low speed

3. When the speed you want to use shows in the display, turn off the instrument.

E. Tubing Cartridge Maintenance and Recalibration

This section describes how to care for the tubing cartridge and then also how to recalibrate the cartridge if you wish to do so.

Note: Recalibration is generally not necessary. The tubing cartridges that come with your system have already been calibrated. That calibration will generally last until the precision limit for the tubing cartridge (1000 dispenses of 100µL each into a 96-well plate) has been reached. In most cases, particularly if all of the channels in the cartridge are no longer meeting precision specifications, you will simply want to replace the disposable cartridge with a new cartridge.

1. Clean the Tubing Assembly

Table 4. Care and Maintenance of Tubing Assembly

Task	How Often?	Procedure
Rinse tubing	After each sample	Use dH_2O to rinse the tubing assembly each time you change samples. Then rinse the tubing with alcohol to remove water.
Wash tubing	At end of day's use or between solutions	Use a mild detergent solution or 10% bleach solution to clean the tubing. Then rinse it with fresh water and finally with alcohol.
Autoclave tubing if desired	As needed.	At 120º C for 20 minutes
Replace tubing	As needed	Obtain a new tube assembly cartridge and install as you did the earlier set.
Clean nozzle tips	As needed.	Inspect the nozzle tips for signs of clogging or debris. Clean them with water and then rinse them with alcohol.

2. Recalibrate the Tubing Cartridge If Necessary

Note: The tubing cartridges to be recalibrated must be allowed to equilibrate to lab-room conditions for at least 2 hours prior to calibration.

Use a gravimetric test or optical scanning with a plate reader to determine whether a particular channel needs to be recalibrated.

1. Turn on the WellMate unit and set the volume to 50µL.
2. Verify that the dispense mode is set for (10) columns of dispense, with 1–10 ON and with 11–12 OFF.
3. Weigh a tube and tare out the scale. Use this tube to collect the dispensed volume of each channel during the calibration sequence. Zero the scale between readings.

   Note: There is a purge before each dispense cycle of the WellMate. It is important NOT to collect this drop in the tube as you perform the following operation. Allow the drop to fall prior to putting the tube under the nozzle.
4. Remove all tubes from the supply water, except channel 1, and make sure that this channel is still primed. Hold a tube under the channel 1 nozzle. Press the **START** key. Proceed to collect each of the (10) dispensed shots in the tube.
5. Weigh the water in the tube. The target weight of the ***liquid*** is **498g–502g.** If the weight is not within these limits, use the **7/64-inch** Allen wrench to turn the adjustment screw for the channel tube (on the supply side of the tubing).

A clockwise turn will **DECREASE** the volume dispensed.

A counter-clockwise turn will **INCREASE** the volume dispensed.

Each **FULL revolution** of the screw will adjust the volume level by approximately 8mg for the (10) shots dispensed (or 0.8mg/dispense).

6. Repeat the previous step until 3 consecutive weights are within the gravimetric range stated above. Do this with all (8) channels. Record results.

7. Fill the supply container with the appropriate medium for your plate reader.

8. Make sure that the plate carriage is properly in position on the unit. Insert a plate in the carriage and position the nozzle tips to correctly dispense into the plate.

9. Select a program to fill the whole plate to the appropriate volume and press the **START** key to begin the dispense.

10. After the dispense operation has finished, insert the filled plate into the plate reader for evaluation.

11. After the plate has been read, evaluate the results. If any CVs for ANY row are greater than the specifications for the tube set, the tube set will need to be adjusted for that channel. Adjust the calibration by turning the adjustment screws as described earlier.

12. After all calibration is completed, rinse the tubing by putting the tube ends in a container holding distilled water and press and hold the **PRIME** key until enough liquid has passed through the tubing to clear it.

13. Repeat the rinse cycle using alcohol to remove all water from the line.

F. Troubleshooting

NOTE: If you do not find the answer to your question in the following table, contact your equipment provider. See page 45 for details on contact information.

Table 5. Troubleshooting: Issues and Solutions

Error	Issue	Solution
E001	Stage doesn't move OR doesn't home.	Press STOP to cancel the alarm. Press **RESET** to return to operation status.
E002	(384-well plates) Stage doesn't return after reaching end position OR limit sensor remains on after stage returns to start position.	Press **STOP** to cancel the alarm. Press **RESET** to return to operation status.
E003	Plate type changes during dispense operation.	Plate selector arm was likely bumped into the wrong position. Press **STOP** to cancel the alarm. Check the plate-type setting and reset it if necessary. Press **RESET** to return to operation status.
C001	PRIME or EMPTY key has been pressed while stage is not at home position.	Press **STOP** to cancel the alarm. Press **RESET** to return the stage to home position. Press **PRIME** or **EMPTY** to continue the operation.
E005	Jaw opened during operation.	Tubing safety bar is open. Raise it until it is in the closed position.

Error	Issue	Solution
	Liquid is dispensing on crosshairs between wells.	Check to see whether stage top is parallel to nozzle tips. If not, ensure that plate carriage is properly engaged on the two pins at the back of the unit. Use a flathead screwdriver to adjust the nylon screws to level the carriage. Also, the mechanism on the bottom of the stage might not be activating, meaning the device is in an incorrect plate mode. Press the stage toward the back of the instrument. Verify needles are at correct height by using nozzle-height spacer guide. Ensure that nozzles are clean. See section D number 5, adjusting the x-axis position
	Plugged nozzle	Remove nozzle head from arm holder, place into container of water or alcohol with supply end of tubing. Using the PRIME and EMPTY keys, flush water or alcohol back and forth through tubing to remove debris.

G. Appendices

1. Chemical Compatibility

The following chemicals have been tested and approved for use with the WellMate tubing cartridges. Please be advised that some of these chemicals may damage the WellMate housing, base plate, or stage, and to use caution when using these chemicals. If you have questions about the use of any chemicals with your WellMate instrument, please contact your equipment provider.

Table 6. Chemical Compatibility (3 pp.; see full notes at table end)

Chemical	Conc.	Temp. (° C)	Result
Acetone	—	20	–
		56	–
Benzyl alcohol	—	20	–
		100	–
Chloroform	—	20	?
Diacetone alcohol	—	20	–
		168	–
Dimethyl formamide	—	100	–
DMSO	100%	20	–
Acetic acid, conc.	—	20	–
		100	?
Acetic anhydride	—	20	–

– = No limit on use.
? = Caution: not appropriate for some uses.
? = Do not use.

Chemical	Conc.	Temp. (° C)	Result
Ethanol	—	20	–
		78	?
Hydrofluoric acid	5%	20	?
Glycol	—	20	–
Glycerol	—	100	–
Hexane	—	20	?
Saline solution	10%	20	–
Methanol	—	65	– (1)
			? (1)
Sodium chlorate	20%	20	–
Phosphoric acid	30%	20	–
	50%		
Hydrochloric acid	10%	20	–
		80	?
Sulfuric acid	10%	20	–

– = No limit on use.
? = Caution: not appropriate for some uses.
? = Do not use.

Chemical	Conc.	Temp. (° C)	Result
Detergent solution	1%	20	–
Hydrogen peroxide	10%	20	–
	30%		

NOTES:

– = No limit to use of tubing under these conditions.

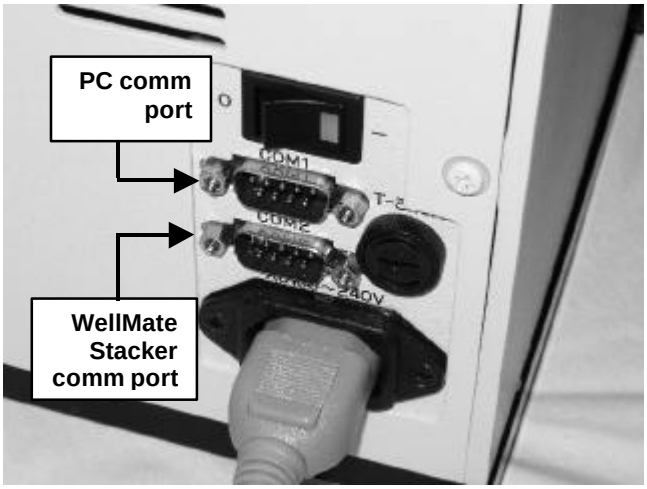
? = Tubing can only be used in a limited range of applications, with that range partly depending on type of stress tubing is subjected to. There are pronounced differences in usability depending on whether exposure to the chemical is temporary or permanent and whether tubing is completely immersed in the medium or has only partial contact with it.

? = The tubing should not be used under these conditions.

(1) Two grades of ELASTOCIL® R tubing were tested with each chemical; those 2 grades are: R401/60 standard mix and R800/80 highly filled mix. Compatibility of the 2 grades with each of the chemicals listed is the same EXCEPT for compatibility with methanol; for standard, compatibility is – ; for highly filled, compatibility is ? .

2. RS-232 ASCII Commands for Remote Device Activation

To send commands to the WellMate instrument from a remote device, provide a Dsub-connector RS-232 cable (to order from Matrix: use item number 501-30019) and a Windows computer. Connect the cable from the COM1 port on the back of the WellMate instrument to your computer.



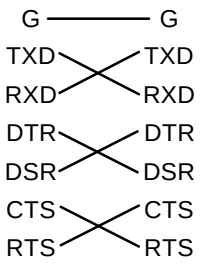
This section lists

- Hardware specifications
- RS-232 commands
- Communication error messages
- Sample commands

Hardware Specifications

1. 9600 bps. STOP 1, PARITY-EVEN, X NONE, BITS-7, ALL ASCII

2.



3. Essential Message Format

SXT ######## EXT

SXT (02H): Start of message

EXT (03H): End of message

Any message not included in SXT and EXT should be ignored as noise.

4. Transmission Protocol

a. Transmit → Correct receive

← ACK

b. Transmit → Incorrect receive

← No response

2 seconds delay

Re-transmit → Correct receive

← ACK

c. Transmission error with repeated “no response” is to be judged by the transmitting side.

d. PC does not return “ACK” against “R” transmission from ***Wel/*Mate**.

5. Common Message

   a. Positive Response STX ACK ETX

      ACK (06H)

Table 7, on the next three pages, lists the ASCII commands you can send from the PC to the WellMate instrument.

Table 8 lists communication error messages.

Some sample commands follow Table 8.

Table 7. RS-232 Commands (3 pages)

Syntax	DATA	Function	Comment
ACK		Positive response	
O		COM OPEN	Open is not allowed during a plate-filling operation; instrument must be idle.
C		COM CLOSE	Terminates RS-232 commands.
R		RESET: Initializing each axis	Used to reset all motor axes.
XS	xxxxx Range of possible values: 01,700–15,000	Stage: Setting speed	Pulses per sec/range. Standard (normal) operating speed = XS01685.
X0		Stage: Move to X home position	Stage homes.
X1		Stage: Move to starting sensor (left-most) position	Stage moves to its left-most position, which is the 384 offset position.
X2		Stage: Move to dispensing position to waste-fluid reservoir (overflow)	Position used for executing a PRIME operation; command must always precede P0 command.
XW	xx	Stage: Move to "xx" column (well) position	Moves to specified column. Values: for 96-well plate, 01–12; for 384-well plate, 01–24.
XW	xx± yyyy	Stage: Move to "xx" column (well) and shift "yyyy" from the center of the well	y (1 pulse) = 0.375mm

Syntax	DATA	Function	Comment
PS	xxxx	Pump: Setting speed	Possible values = 0500–01000. Standard (normal) pump operating speed = PS00492.
P0		Pump: Move to the original position (4 different positions) in the dispensing way.	**This action is to be done prior to every plate-filling sequence. It ensures pump head is at Start position.**
P1		Pump action: Start dispensing	Continue pump action until P3 command is executed.
P2		Pump action: Start pumping in reverse direction (to supply)	Reverses pump motor action. Used for extracting fluid left in tubing back into supply container.
P3		Stop pump action.	Stops the pump motor. Only effective for P1 & P2 commands.
P±xxxxx	xxxxx	Pump action: + = dispense; - = pump motor runs in reverse	Programs volume to dispense into plate (+) or returned to supply container (-). **NOTE:** 0.025xxxxx = value in µL; e.g., P+04000 = 100µL to be dispensed
P		Pause all motion	Pause occurs after current operation has finished.
A		Restart after the pause and the error.	Resumes from the point where pause or error occurred.

Syntax	DATA	Function	Comment
QX		Query: What is column (well) position?	Queries for ASCII packet that identifies the column (well) location. Only effective for XW command that last moved X-axis.
QA		Query: Is stage at home position?	0 = Stage not at home 1 = Stage at home
QB		Query: Is stage at start position? (384-well plate position, left-most position for stage)	0 = Stage not at start 1 = Stage at start
QC		Query: is plate type set to 96 or 384 mode?	0 = 96 mode 1 = 384 mode
QD		Query: Is jaw on pump mechanism open?	0 = closed 1 = open
W	xxx Possible values: 001–250	Wait time: (xxx * 10) mSEC	Min. delay time = .002 (20mSEC) Wait time = time system waits between executing column dispenses (P1 commands). Must build in wait time to avoid dispenses on crosshairs between wells.

Table 8. Communication Error Messages

Error	Description
E01	Stage is not at home position. Command X0 cannot execute until stage is at home. Also, error occurs if home sensor or stage motor is not working.
E02	Stage is not at start (left-most) position. Command X1 cannot execute until stage is in start position. Also, error occurs if start sensor or stage motor is not working.
E03	Plate-type selector was moved, switching plate type, while commands were being transmitted. Do not move selector while commands are being transmitted. Also, error occurs if plate-type sensor is not working.
E04	Cover on pump mechanism was opened while pump-action commands were activated. Lift safety bar until it is in its closed position.
E99	Did not packet command correctly (wrong format for command); e.g., **W 12** does not contain enough digits for the wait time command format.

Sample RS-232 commands

The following sample commands dispense **100µL** into a 384-well microplate. Comment lines appear with asterisks at the beginning and end of the line.

In the following commands:

- Tx = Transmitted command from PC to WellMate instrument.
- Rx = Response from WellMate instrument to PC.
- Each “ACK” is an acknowledgement that a command has been received.

Query: Is stage at home position?

Tx	· QA ·
Rx	ACK
Rx	· A1 ·
Tx	ACK

Rx	· OK ·
Tx	ACK

Move stage to position with column offset one pulse and then query stage position after XW command has been sent.

Tx	· XW12-001 ·
Rx	ACK
Rx	· OK ·
Tx	ACK
Tx	· QX ·
Rx	ACK
Rx	· XW12-001 ·
Tx	ACK
Rx	· OK ·
Tx	ACK

Response to command QA, which was sent after COM close command was sent, is error E99.

Tx	· C ·
Rx	ACK
Rx	· OK ·
Tx	ACK
Tx	· QA·
Rx	ACK
Rx	· E99 ·

Tx	ACK

COM open and COM close commands sent.

Tx	· O ·
Rx	ACK
Rx	· 2. 1, A1, B0, C1, D0, XW00+000 ·
Tx	ACK
Rx	· OK ·
Tx	ACK

Tx	. C .
Rx	ACK
Rx	· OK ·
Tx	ACK

COM open command sent.

Tx	· O ·
Rx	ACK
Rx	· 2. 1, A1, B0, C1, D0, XW00+000 ·
Tx	ACK
Rx	· OK ·
Tx	ACK

Initializing

Tx	· R ·
Rx	ACK
Rx	· R ·

***Dispense into the reservoir and 384-well microplate; dispense vol. = 100µL. Wait 20mSEC before pump motor turns on and pump moves in dispense direction. NOTE: 0.025xxxxx = value in µL; e.g., P+04000 = 100µL to be dispensed into plate.** *

Tx	·X0X2P0XW01W002P+04000XW02W002 P+04000XW03W002P+04000XW04W002 P+04000XW05W002P+04000XW06W002 P+04000XW07W002P+04000XW08W002 P+04000XW09W002P+04000XW10W002 P+04000XW11W002P+04000XW12W002 P+04000XW13W002P+04000XW14W002 P+04000XW15W002P+04000XW16W002 P+04000XW17W002P+04000XW18W002 P+04000XW19W002P+04000XW20W002 P+04000XW21W002P+04000XW22W002 P+04000XW23W002P+04000XW24W002 P+04000XW24W002P+04000XW23W002 P+04000XW22W002P+04000XW21W002 P+04000XW20W002P+04000XW19W002 P+04000XW18W002P+04000XW17W002 P+04000XW16W002P+04000XW15W002 P+04000XW14W002P+04000XW13W002 P+04000XW12W002P+04000XW11W002 P+04000XW10W002P+04000XW09W002 P+04000XW08W002P+04000XW07W002 P+04000XW06W002P+04000XW05W002 P+04000XW04W002P+04000XW03W002 P+04000XW02W002P+04000XW01W002 P+04000X0·
Rx	ACK
Rx	· OK ·
Tx	ACK

3. Customer Service

Your comments and suggestions for improving the performance and versatility of the instrument are always welcome and appreciated. We also appreciate your comments and suggestions for improving this manual.

If you have any questions about your WellMate instrument, contact your equipment provider. Some of those contacts are listed below. If your instrument was provided by a distributor not listed here, contact that distributor.

(If you need to return the instrument for any reason, see the instructions provided in the Warranty on page 46 of this manual.)

Corporate Headquarters
22 Friars Drive
Hudson, NH 03051 USA
Tel: 603-595-0505
800-345-0206
Fax: 603-595-0106

European Headquarters
Lower Meadow Road
Brooke Park
Handforth,Wilmslow
Cheshire, SK9 3LP, UK
Tel: +44 (0) 161 486 2110
Fax: +44 (0) 161 488 4560

Asia-Pacific Headquarters
Akami-14-11-705
Urayasu-City
Chiba-Pref
279-0014 Japan
Tel: 81 (0) 47 355 6491

Warranty

Record the serial number for your WellMate instrument here:

WellMate instrument	

The WellMate instrument is warranted against defects in material and workmanship for one year from the date of shipment. Parts subject to normal wear, such as tubing sets, are excluded.

Do not try to service or repair a WellMate instrument under warranty before first contacting your equipment provider. See page 45 for contact information.

If service is required after the warranty period, it is still advisable to consult with your equipment provider before performing the service task, especially when the repair may be technically sophisticated or difficult.

If you need to return the instrument or parts of the instrument to your equipment provider for any reason, follow this procedure:

1. Contact your equipment provider and obtain return approval, a return authorization number, and a return authorization (RA) form. (The form will be sent to you.)

   CAUTION: Fill out the RA form completely. Ensure that the completed RA form is included in the return package. Do NOT return the instrument or its parts without this completed form.

2. Do not return any of the accessories unless you believe there is a problem with one of them.

3. Package the instrument in its original packing materials. All equipment being returned to the equipment provider for any reason must be shipped in the original shipping containers and packaging. If you do not have the original shipping containers and package, you must purchase them. See the

price list on the Matrix Technologies website at www.matrixtechcorp.com or contact your equipment provider.

4. Ship the returned material by 2-day air service.

The contents of this manual may change as new features and accessories are added. Your comments and suggestions for improving the performance of the instrument and the usefulness of this manual are always welcome and appreciated.

Packing List

The following items have been provided with your WellMate system. Contact your equipment provider if items are missing.

- Base unit
- AC power cord
- Two disposable 8-channel tube assemblies, with silicone-based tubing and polypropylene nozzles. One each of:
  - Standard-bore tubing cartridge, for use with 96-well (shallow or deep well) microplates.
    - Nozzle orifice ID 0.023in (0.58mm).
    - Dispenses volumes 20–2000µL.
    - Applications include sterile plate filling and dispensing of cellular materials, viscous fluids, and beads.
    - To order replacement 5-pack, use item no. 201-30001.
  - Small-bore tubing cartridge, for use with 96- and 384-well (shallow or deep well) microplates.
    - Nozzle orifice ID 0.015in (0.38mm).
    - Dispenses volumes 2–200µL.
    - Applications include sterile plate filling, dispensing of high vapor pressure fluids, and dispensing of small volumes (2–200µL) with enhanced precision.
    - To order replacement 5-pack, use item no. 201-30002.
- Nozzle-height reference scale
- Nozzle-height spacer guide
- 7/64-inch Allen wrench (for use in tubing-cartridge adjustment)
- Universal-microplate removable stage
- Waste-fluid vessel with tubing
- This manual

List of Replacement Parts and Accessories

You can purchase additional tubing assemblies as well as other replacement parts and accessories for the WellMate instrument. See the latest price lists, contact your equipment provider, or check the product list on the Matrix Technologies website at www.matrixtechcorp.com.

Item No.	Description	Unit
201-30001	Tube assembly cartridge, standard-bore (0.023in/0.58mm ID)	5/pk
201-30002	Tube assembly cartridge, small-bore (0.015in/0.38mm ID)	5/pk
22648	Removable plate carriage/stage	Each
22664	Waste-fluid vessel	Each
501-30019	RS-232 cable	Each

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