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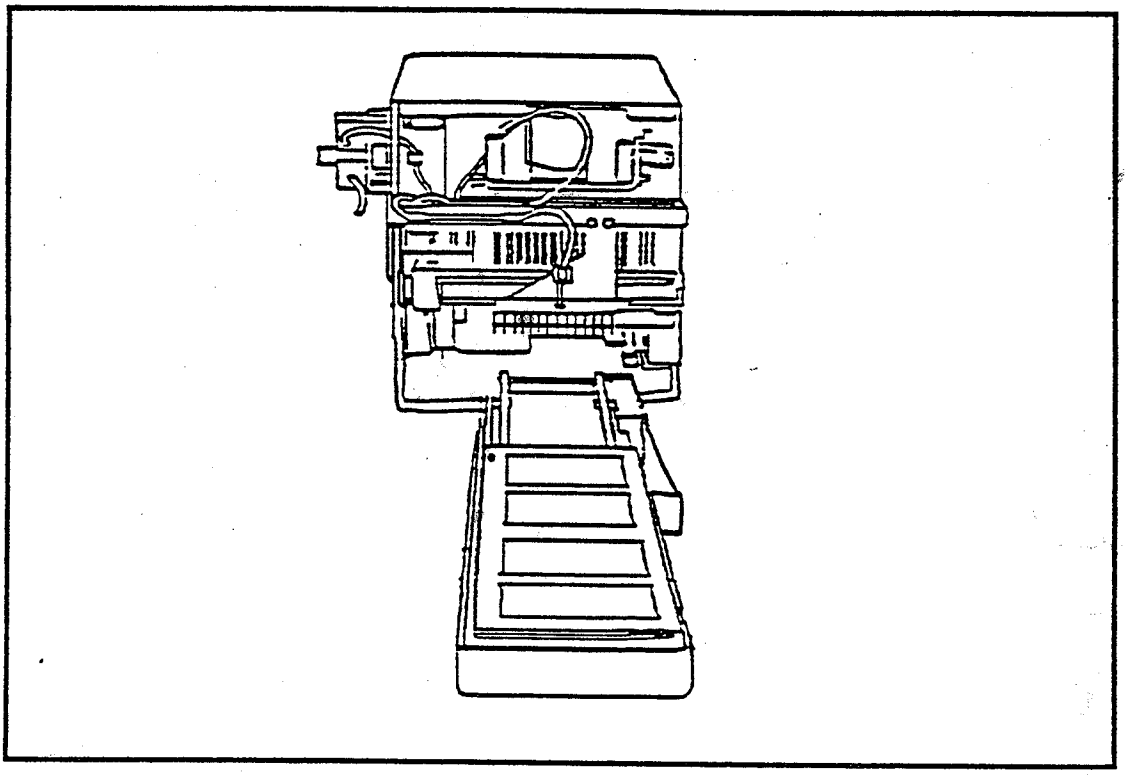
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Find the *Thermo / LabSystems WellPro 96* at our website: *Click HERE*

Operation Manual
OM7500

WellPro

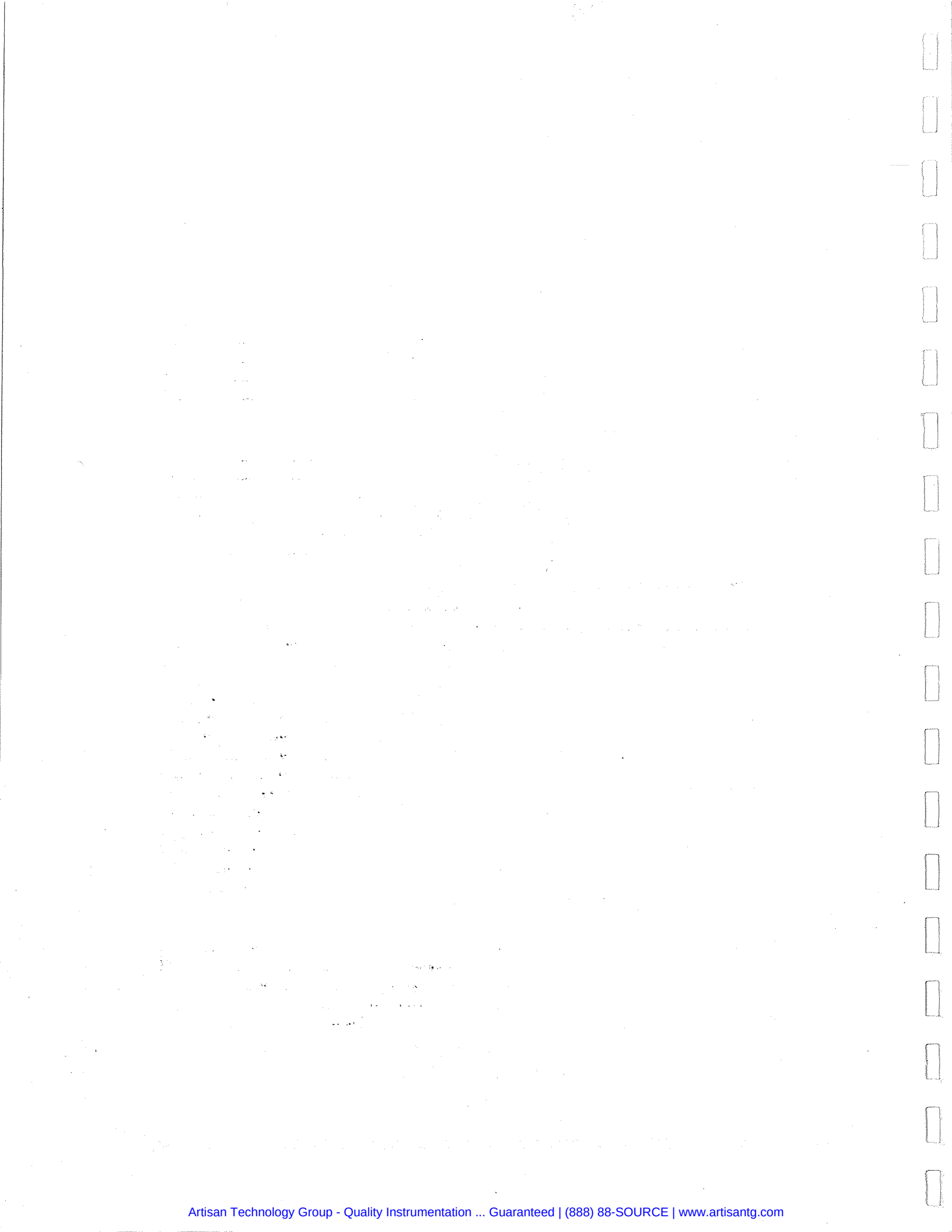
Liquid Handling System



Thermo Labsystems
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Franklin, Mass 02038

1-800-LAB-PROD
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Typographical Conventions

Content inside of [ ] refers to keys on the WellPro keypad (i.e.: [start] directs users to press the **start key.**

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Introduction

The WellPro Liquid Handler is capable of performing almost all types of liquid handling involving microplates. Examples of WellPro liquid handling skills are serial dilution, plate filling, plate emptying and replica plating.

You'll find it easy to have the WellPro Liquid Handler:

- Perform serial dilutions in almost any ratio
- Perform serial dilutions 8 or 12 wells across
- Mix, precisely, the contents of a microplate
- Empty supernatant media and feed cultures
- Fill microplates with diluent
- Transfer samples to or from microplates to an assay plate
- Perform replica plating
- Wait for the precise moment to add a particular reagent
- Perform in vitro diagnostics

Refer to the Operating Instructions, for easy-to-follow instructions, to learn how to operate the WellPro.

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WellPro Specifications

Dimensions:	Controller	Main Unit	(Optional) Main Unit with Pumps	(Optional) Main Unit With Carousel
Height	2.5"	16"	16"	16"
Width	6.5"	12"	15.5"	25"
Depth	6.75"	28.5"	28.5"	28.5"
Weight		70 lbs. (30.2 Kg)		
Power Requirements	120/220/240 VAC, 47-63 HZ, 2 Amps at 120 VAC, 1 Amp at 240 VAC			
Fuse	3 Amps, 250 V, Normal blow			
Room Temperature	23 ± 3°C (68 -79° F)			
Volume Range	0 - 200µL, programmable in 1µL increments, for tips; 25-2000µL, programmable in 1µL increments, for dispense manifold (25-2000µL, with [help] key override)			
Accuracy	Typically 50µL ± 1µL, with phosphate buffered saline, at 23°C, using tips: typically 100µL ± 4µL, with deionized water, at 23°C, using dispense manifold.			
Precision	Single and multichannel head; typical coefficient of variation; less than ±1% at 100µL, with deionized water, at 23°C, using dispense manifold.			
Time Delay	Programmable from 1 second to 999 minutes, in 1 second steps. Accurate to 1 part in 1000 or better, over ambient temperature range.			
96 Well Microtitration Plates	96 well (12 x8), 5" x 3.24", flat, U, or V bottom microtitration plates typically used.			
Wash Volume	0-9.99mL per well, programmable in 1µL steps. Soak time programmable in 1 second intervals, up to 999 minutes, 59 seconds (Optional)			
Dispense Manifold	One 12 channel manifold (Optional)			
Wash Manifold	12 Channel autoclavable manifold, with independent wash, drain, and overflow lines. Vacuum aspirate (vacuum source not supported by Denley). Delivery by peristaltic pump. Vacuum is controlled via computer operated solenoid (Optional)			
Carousel	48 position, positive locating. Holds tubes 12x100mm to 13x100mm (diameter x height).			
Stacker	6-10 plate stacker (Optional)			

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Installation

Power Requirements

The WellPro operates on a 120 VAC, 50/60 Hz input voltage, with maximum power consumption of 360 watts. Instruments intended for operation at 100 VAC, 220 VAC, and 240 VAC, have been modified internally. They can be identified by the nonstandard power cord, and the operating voltage printed on the serial number tag. **Verify that this voltage is correct, before installation.**

WellPro Liquid Handlers, sold in the United States, are supplied with a three-conductor power cable, and a three-terminal plug, that affords an earth ground. For protection against shock hazards, the electrical outlet **must** be a three-terminal type, properly wired, according to the U.S. National Electrical Code. Denley **does not** recommend the use of an adapter to a two-terminal outlet.

Physical Location

Place the WellPro on a stable, level bench or hood. Excessive jarring or vibration, during operation, may affect its performance.

Room temperature should be a constant 20-26°C (68-79°F). To prevent temperature fluctuations, do not place the WellPro in direct sunlight, near equipment that gives off heat, or under heating or air-conditioning outlets.

Unpacking And Inspection

The WellPro is shipped in one double-cartoned container, which should contain the items listed on the WellPro Inventory Packing List. Confirm that all of the items are present. If there are any discrepancies, please notify your salesperson.

If any items have been damaged during transit, promptly notify the carrier and the salesperson. Denley recommends that you save the shipping container and packing material, in case you need to move or ship the instrument again.

Assembly of the WellPro Liquid Handler

End users can install the basic WellPro. If the unit was purchased with additional accessories (carousel, plate stacker, or pump assembly), installation will be performed by an authorized Denley representative.

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Installation Instructions

- Remove the unit from the shipping carton
- Refer to the checklist, to ensure that all items have been received
- Ensure that all installation procedure requirements have been fulfilled
- Place the unit on a sturdy, level table top
- Place the keypad next to the WellPro. Connect one end of the white cable to the keypad. Connect the other end to the jack on the back of the WellPro
- Plug the power cord into the WellPro power module, at the back of the unit. Plug the other end into the proper power outlet.
- Turn on the power switch (right side of back of WellPro). The unit will raise the head assembly, and the bed of the unit will **home**. Remove the shipping material on the bed.

Read the operator manual, before operating the WellPro, to avoid damaging the unit.

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WellPro Inventory Packing List

The WellPro comes assembled in double-cartoned container. A third box contains accessories.

Quantity	Description	Part Number
1	WellPro Liquid Handler (long base)	WP1000
	or	
1	WellPro Liquid Handler (short base)	WP1000S

The accessory box contains the following items:

Quantity	Description
1	Hand-held controller
1	Power cord
1	Controller cord
1	**Blue** plastic cover
1	Operator's Manual
3	Templates • 12 Way Template - serial dilution, plate-to-plate • 8 Way Template - serial dilution • 12 Way Template - plate filling
1	Fuse

Optional accessories, that can be included at the time of purchase, or installed, at a later date, at your facility, include:

- Dispense manifold with reagent pump
- Plate washing system
- Carousel with bar code reader
- Plate stacker

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Principles of Operation

Introduction

The basic WellPro instrument consists of a hand-held controller and a liquid handling unit. Some models may, also, contain other options, such as the dispense manifold and reagent pump, x-y head and carousel, and wash head and pump.

WellPro Controller

The WellPro controller has a keypad and display, which enable you to interact with the WellPro. This gives you control of unit functions, such as the volumes to transfer, mix, or dispense; the transfer speed; and whether to change tips between transfers.

WellPro Liquid Handling Unit

The electro-mechanical transfer unit is comprised of two basic parts: a table and a vertical head assembly. The table accommodates interchangeable templates, which position reagent containers; a magazine with rows of disposable tips; or other items. During operation, the table moves, via stepper motors, to, accurately, bring the tip rack, trough, or microplate, to be positioned under the transverse head assembly.

The head assembly consists of three basic parts: a plunger housing, which contains nozzles that press into the tips, to form airtight seals; a plunger block, which moves up and down to aspirate and deliver samples; and a tip ejector plate, which removes used tips. The head assembly slides up and down, vertically, to bring the tips to the appropriate height to perform designated operations.

The WellPro uses two types of air displacement pipetting heads:

- a ganged, 12-channel pipetting unit, to manipulate liquid within the microplates and reagent containers.
- a single channel pipetting head, used to transfer samples from the optional carousel with tubes to microtitration plates on the WellPro table.

WellPro Microtrough

The microtrough container consists of three reservoirs and two rows of tips. Each reservoir holds a different amount of liquid. Their capacities are 20, 58, and 77 ml. You can use the reservoirs to hold reagents that will be added to a plate, waste that has been removed from a plate, or liquid that has been discharged, while priming the pump. The microtrough container is used with general purpose liquid handling files.

Microtrough tips are designated for rows **I** and **J**. They are used during a wash or a plate-filling operation, when tip changes are not required.

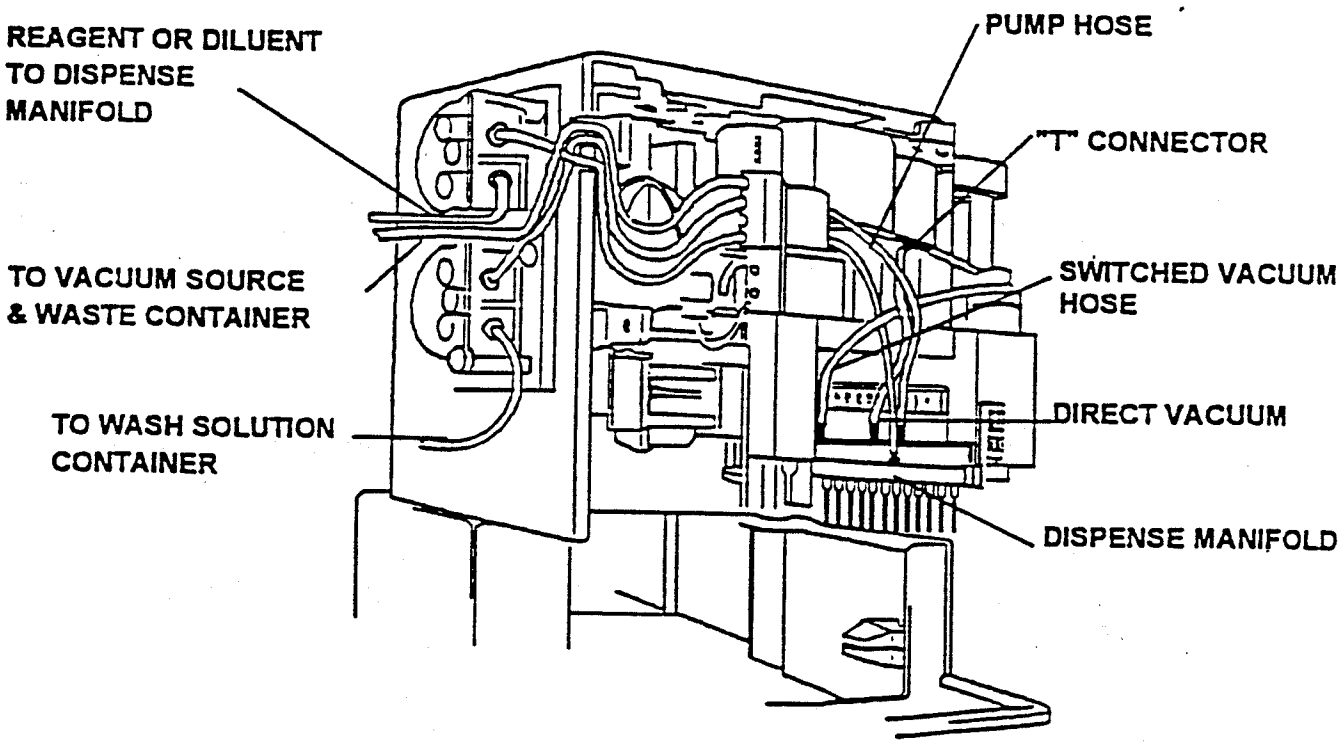
WellPro Templates

The WellPro uses templates to secure microplates, reagent containers, and tip magazines, on the movable table. Three templates are supplied, to cover the wide range of functions and operations which can be performed.

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Pro/WASH Plate Washing System (optional)

The **optional** Pro/WASH Plate Washing system allows you to automatically wash 1 or 2 plates, separately or as a part of an assay sequence. The Pro/WASH system uses an external vacuum source, metered by a computer controlled solenoid valve, to feed wash solution into the wells of a 96 well microtitration plate, while aspirating waste solution. Wells are drained, upon wash completion, and ready for the next reagent addition step. The wash buffer is fed by a peristaltic pump which allows a maximum of 10 ml of wash solution to be passed through each well.

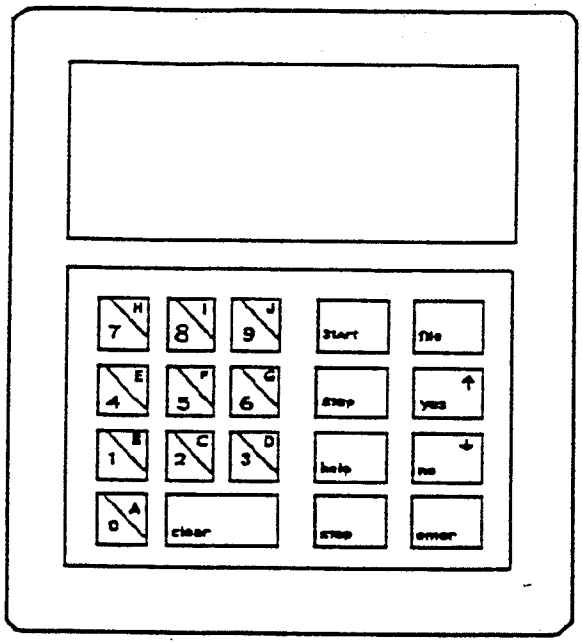


Pro/WASH Plate Washing System

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WellPro Controller Nomenclature and Definitions

The hand-held controller contains 10 alphanumeric keys, nine control keys, and a display. This section describes the function(s) of each key:



J 9	The alphanumeric keys, which have alphabetic and numeric symbols, enable you to input information to the WellPro controller.

file	**Files** are stored sets of instruction and conditions, used by the WellPro to perform sequenced tasks. When you press the **[file]** key, the file number, and the **[enter]** key, you direct the WellPro to run a file.

There are seventy WellPro files available. Files 51 through 70 are preprogrammed by Denley. You can modify them to create new files. Files 1 through 45 are user-storage files. These are the initial standard files:

0	HOME-PUMP PRIME*	64	PLATE EMPTY*
53	NOT USED	65	TIME DELAY*
55	PRO/WASH FILE	66	NOT USED
60	NOT USED	67	NOT USED
61	PLATE FILLING*	68	PLATE STACKER
62	SERIAL DILUTION*	69	NOT USED
63	PLATE TO PLATE*	70	TIP HEIGHT*

These files are described in the WellPro **Preprogrammed Files And Display Definitions** section of this manual.

* indicates files for the basic WellPro unit.

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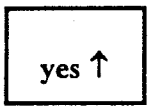
The **[step]** key has several functions. Pressing **[step]** at the beginning of a file indicates that you want to edit or review a file, before running.

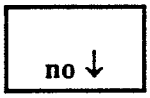
Pressing **[step]**, while editing a file, indicates that you accept the parameter value on the display, and are ready to input/review the next parameter. Pressing **[step]** when **END OF FILE** is displayed, skips back to the beginning of the file, so that you can review/revise the file.

If you press **[stop]**, followed by **[step]**, while the WellPro is running, you can go review files one motion at a time. In this mode, the WellPro stops after each motion. Press **[step]** to advance. Press **[start]** to return to normal operation.



Pressing **[enter]**, after pressing an alphanumeric key, enters the displayed information into a file. Pressing **[enter]** at the end of a file instructs the WellPro to run the file.





[yes] and **[no]** are used to respond to queries posed by the WellPro.

Here are some examples which use **no** to underline the next option Each option is underlined, in sequence, until you press **[step]**.

DELIVER FROM	LIQ HANDLING SPEEDS
T1-T2-T3-PUMP	RAPID-MEDIUM-SLOW
NUMBER OF PLATES	END OF FILE
1-2 RUN-STORE-PRINT	
PLATE TYPE	CHANGE TIPS?
FLAT-U-V-HEIGHT-TUBE	YES-NO
PLATE ORIENTATION	WASTE TO TROF
12-8 WELLS ACROSS	T1-T2-T3

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In this example, **[yes]** indicates that the underlined option should be included in the list of rows to dilute. **[no]** indicates that the underlined option should be removed from the list.

ROWS TO DILUTE		ROWS TO DILUTE
A-B-C-D-E-F-G-H	or	A- -C- -E- -G-H
Y-Y-Y-Y-Y-Y-Y		Y-N-Y-N-Y-N-Y

yes ↑

The arrow keys [↑] and [↓] are only used for File 70.
They direct the WellPro to raise (↑) or lower (↓) the tip height in the wells.

no ↓

clear

[clear] removes displayed information, before it is entered into the WellPro controller. Selecting **[file]**, the file number, **[enter]**, **[file]**, and **[clear]**, erases a user-created file from WellPro memory.

help

[help] gives information about parameter ranges and sequences. During file editing, **[help]** allows you to over-ride range limits of many parameters. During programming, the WellPro controller verifies parameter validity, such as transfer volume, by checking against the allowable range of values (shown on the display). Pressing **[help]** instructs the WellPro to accept **any** entered value, subject only to physical limitations of the instrument.

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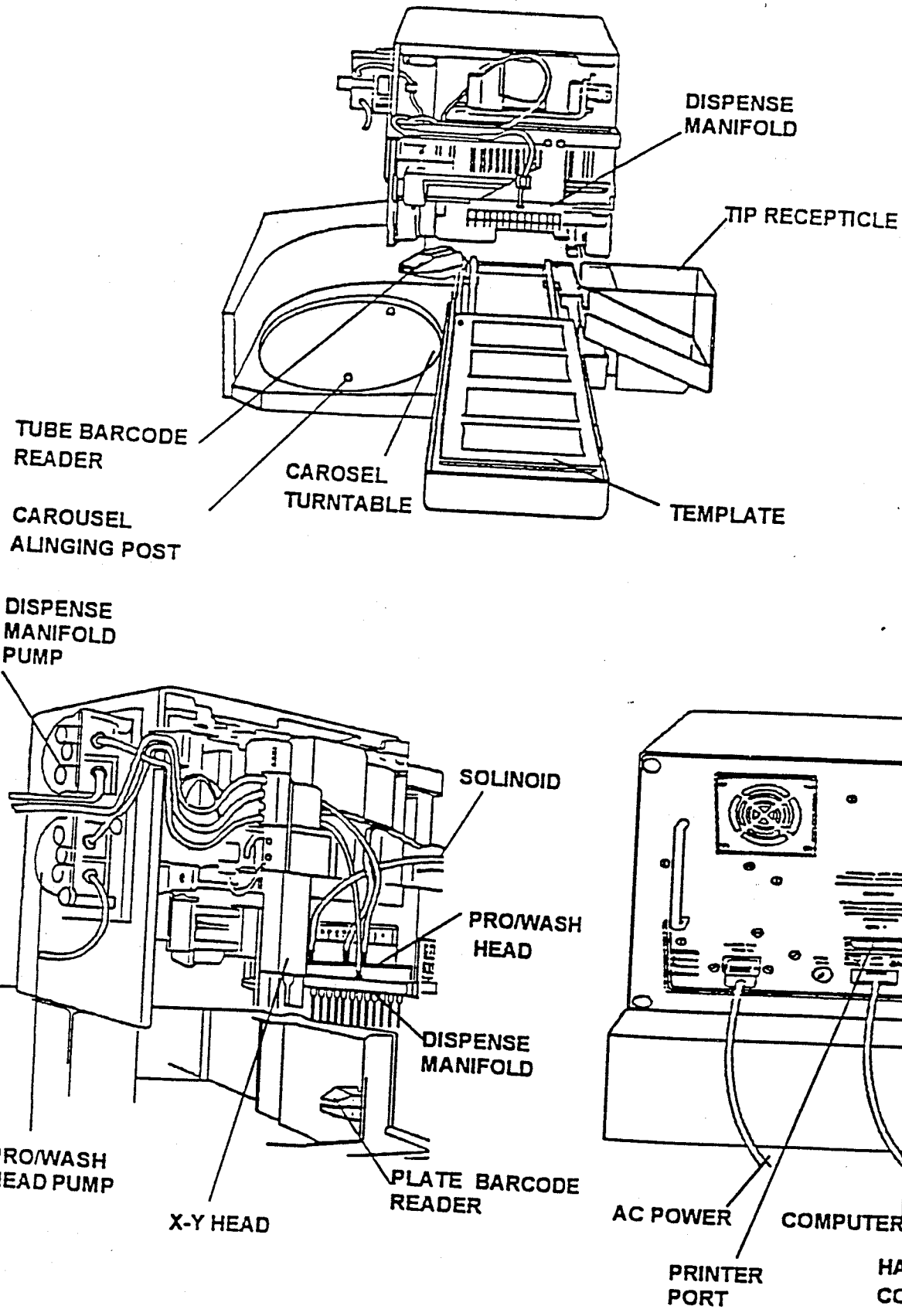


Pressing **[start]**, at the beginning of a file, instructs the WellPro to run a file. Pressing **[start]** can, also, restart a file if it has been stopped (paused) before completion.



Press **[stop]** to stop editing a file, and the display will read END OF FILE. At this point, you have two choices: press **[enter]** and **[start]** to run the file. Press **[stop]**, again, and you will be able to enter a new file. Pressing **[stop]**, while running a file, tells the WellPro to stop running (pause). Once the WellPro has paused, you may abort the file (by pressing **[stop]** again), or go through the file one motion at a time (by pressing the **[step]**). **[stop]** is, also, used to break out of the Tip Height file, and to stop priming the pump in the Home-Pump Prime file.

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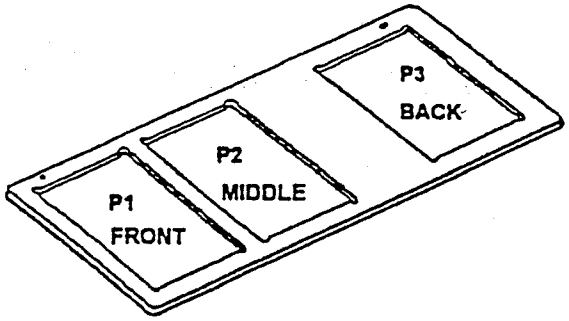


THE PROGROUP LIQUID HANDLER

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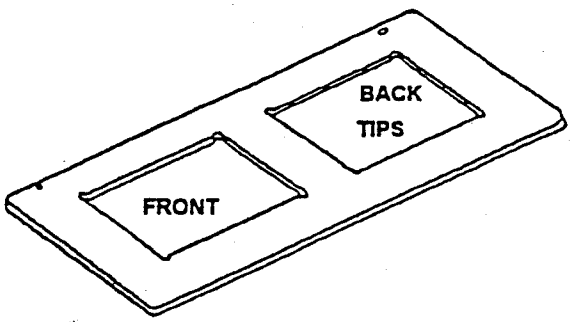
WellPro Unit Nomenclature

The following figures show important WellPro components:



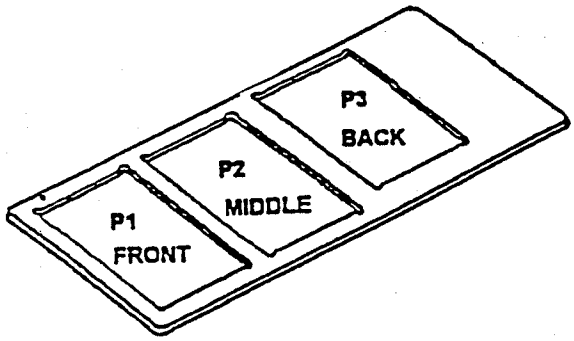
Standard 12 way template

- Serial dilution
- Plate-to-plate transfer



Standard 8 way template

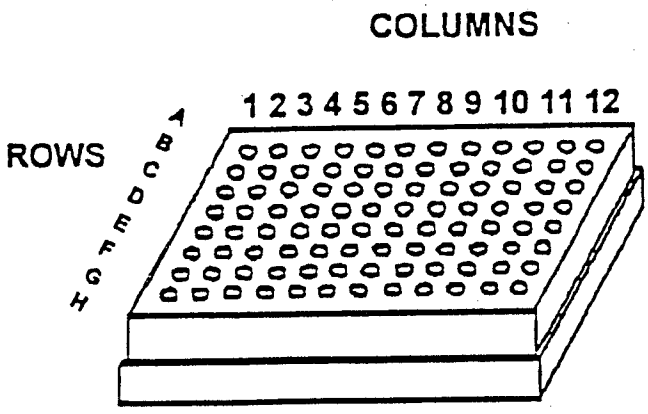
- Serial dilution



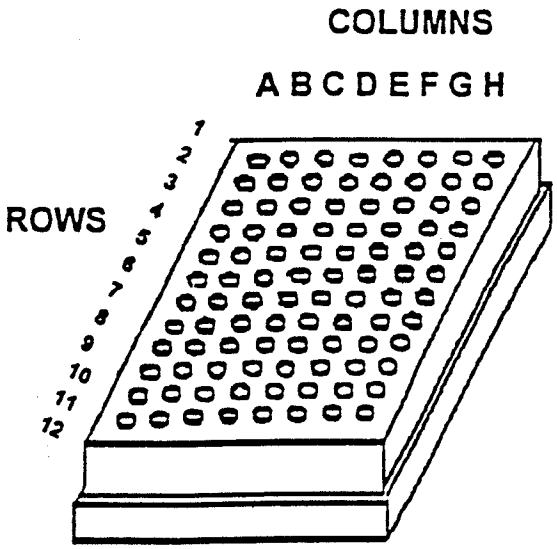
8 way template

- Plate filling

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12 way plate



8 way plate

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WellPro Preprogrammed Files and Display Definitions

Introduction

Files are sets of instructions and conditions, which direct the WellPro to perform its sequenced tasks. Files 51 through 70 are preprogrammed files. They contain preset values, which you can retain or change. Edited files may be stored in the user memory locations (File 1 to File 45). Files such as the ABO/Rh files may be locked, to prohibit editing.

This section describes standard WellPro files. The preset values are underlined in the text, as they are, on the display. Acceptable ranges are enclosed in parentheses.

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Operating Instructions

Introduction

The WellPro contains preprogrammed files. You may customize and save versions of these files.

Refer to the Operating Instructions and Display Definitions sections, in this manual, to learn to edit files and run the instrument. You can run the examples in this manual. **Use distilled water,** for liquids, in these exercises. You cannot harm the WellPro by making mistakes in these exercises.

These examples use the following conventions to represent the WellPro display:
Numerical Parameters have parameter names on the first line. The acceptable range are in parentheses, in the left-hand corner of the second line. Underlined preset values are in the right-hand corner of the second line. Here is an example of this format:

VOL IN WELL AT START
(0-350) 0ul

- Press **[step],** to accept the preset value,
- Press the appropriate number keys, to enter another value, within the acceptable range. The new number will replace the preset value.
- Press **[enter],** to move to the next parameter.
- Press **[step],** when **END OF FILE** is displayed, to review or reedit a file.

Some parameters allow you to **select one of several options**. The parameter name will be on the first line, and the options will be on the second line. The default option will be underlined. Here is an example of this format:

PLATE TYPE
FLAT-U-V-HEIGHT

Press **[no]** to move the underlines across the list of options. When the option that you want is underlined, press **[enter]** to select the option. The next parameter will appear on the display.

Press [step], to review a file. When **END OF FILE** is displayed, all of the options for the parameter, will be displayed. The selected option will be underlined.

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Some parameters allow you to select **more than one option,** from a list. For these parameters, the name of the parameter and the options will be displayed on one or two lines, with the first option underlined. Here is an example of this format:

FILL PLATE 1 ROWS
A-B-C-D-E-F-G-H

- Press **[step]**, to accept all of the options,
- For parameters with multiple choices, press **[yes],** for the options that you want to include, and **[no],** for each option that you want removed from the list.
- Press **[enter]**, to save the changes. The next parameter will appear on the display.
- When you review the file, the display will reflect the options that you have selected.

Questions?

If you have any questions about the sample files, **contact Denley Technical Service: Telephone (800) 843-1113 / FAX (617) 455-9749**

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File 0: Homing

Homing the WellPro allows the unit to position itself into the starting mode, for accuracy.

This example demonstrates how to:

- **Home** the WellPro, without priming the optional pump

1. Turn on the WellPro. The switch is located on the back, right-hand side.
2. Press **[start]**, to access and run File 0.
3. After homing, note the effect of the following keystrokes:

Display Before Editing	Keystrokes	Display After Editing
HOME-PUMP PRIME. START TO RUN FILE# 0	[start]	HOME-PUMP PRIME RUNNING FILE #0
HOME COMPLETE.... YES TO PRIME PUMP	[no]	HOME-PUMP PRIME START TO RUN FILE #0

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File 0: Homing and Priming, if the optional dispense pump is installed

This example demonstrates how to:

- **Home** the WellPro,
- Prime the optional fill pump and dispense manifold, if these options are installed on your **instrument**
- Move to an operating file (File 61)

1. Turn on the WellPro
2. Press **[start]**, to run File 0.
3. Place the end of the dispense manifold tubing into a flask that contains the solution (water, in the example) to be dispensed.
4. Place a 12 way template on the table .
5. Place a microtrough container in the front position, with the small reservoir toward the front of the WellPro, and the tips toward the back.
6. Loosen, slightly, the nut that holds the clamp block on the **upper** peristaltic pump.
7. Edit the file, using the following keystrokes:

Display Before Editing	Keystrokes	Display After Editing
HOME-PUMP PRIME. START TO RUN FILE# 0	[start]	(WELLPRO GOES TO HOME POSITION)
HOME COMPLETE.... YES TO PRIME PUMP	[yes]	PLACE TROF AT BED 1 START TO RUN PUMP
PLACE TROF AT BED 1 START TO RUN PUMP	[start]	STOP TO END FILE
STOP TO STOP PUMP	[stop]	STOP TO END FILE START TO RUN PUMP
STOP TO END FILE... START TO RUN PUMP	[stop]	HOME-PUMP PRIME COMPLETE FILE #0
HOME-PUMP PRIME. COMPLETE FILE #0 ..	[file] [6] [1] [enter]	PLATE-FILLING STEP TO EDIT FILE 61

8. Tighten the peristaltic pump nut, finger tight, before using the pump to fill your plates.

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Storing, Recalling, And Clearing A File: First Available Location

This example demonstrates how to:

- Store, recall, and clear a file that you have created, by editing one of the WellPro preset files.
- Store the file in the first available memory storage location.
- Assign an operator or project identification number of 1234 to the new file.

1. Press **[file]**, **[6]** **[2]**, and **[enter]**, to access File 62.
2. Press **[step]**, until you reach the **END OF FILE** statement.
3. At the end of the file, use these keystrokes to store the file in the first available memory location:

Display Before Editing	Keystrokes	Display After Editing
END OF FILE RUN-STORE	[no] [enter]	FILE STORE ENTER USER #____
FILE STORE ENTER USER #____	[1] [2] [3] [4] [enter]	
FILE STORE ENTER FILE #1	[enter]	
YES TO STORE USER #1234 FILE #1	[yes]	
SERIAL DILUTION STEP TO EDIT FILE #62		

Be sure to record and remember the user number.

4. Turn the WellPro off. Wait 20 seconds, and then turn it back on. (You don't need to turn the WellPro off to store a file. It is done to demonstrate that files are not lost when the WellPro is turned off.)
5. When the WellPro completes its self-test, press **[file]**, **[1]**, and **[enter]**.
6. Use the **[step]** key to move through the file. You may re-edit the file, at this, point, if you wish.
7. Press **[file]**, then **[clear]**, to clear the file from memory.
8. When the display reads YES TO DELETE FILE; USER # 1234 FILE #1, press **[yes]**.
9. The controller will erase the file, and display:
   FILE #1 DELETED; ENTER NEW FILE # ___.

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Storing A File in Other Than First Available Location

This example demonstrates how to:

- Store a file that you have created, by editing one of the preset files.
- Store the file in a location **other than the first available storage location** in memory.
- Assign an operator or project identification number of 1234 to the file.

1. Press **[file]**, **[6] [2]**, and **[enter]**, to access File 62.
2. Press **[step]**, until you reach the END OF FILE statement.
3. At the end of the file, use the following keystrokes to store the file in location 32.

Display Before Editing	Keystrokes	Display After Editing
END OF FILE RUN-STORE	[no] [enter]	FILE STORE ENTER USER #
FILE STORE ENTER USER #	[1] [2] [3] [4] [enter]	
FILE STORE ENTER FILE #1	[3] [2] [enter]	
YES TO STORE USER #1234 FILE #32	[yes]	
SERIAL DILUTION STEP TO EXIT FILE #62		

4. Turn the WellPro off, wait 20 seconds, and then turn it on. (You don't need to turn the WellPro off to store a file. It is done to demonstrate that files are not lost, when the WellPro is turned off.)
5. When the WellPro completes its self-test, press **[file]**, **[3] [2]**, and **[enter]**, to store the file in location 32.
6. Use **[step]**, to move through the file. At this point, you may reedit the file.

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Storing A File: Overwriting an Existing File

This example demonstrates how to:

- Store a file that you have created, by editing one of the WellPro preset files.
- Overwrite the file that you placed in location 32, during the previous (STORING A FILE) example.
- Assign an operator or project identification number of 5678, to the file to be stored.

1. Press **[file]**, **[6]** **[3]**, and **[enter]**, to access File 63
2. Edit the file using the keystrokes shown in the **FILE 63: PLATE TO PLATE TRANSFER** example.
3. At the end of the file, use the following keystrokes to store the file in location 32:

Display Before Editing	Keystrokes	Display After Editing
END OF FILE RUN-STORE	[no] [enter]	FILE STORE ENTER USER #____
FILE STORE	[5] [6] [7] [8] [enter]	ENTER USER #
FILE STORE	[3] [2] [enter]	ENTER FILE #1
FILE #32 IN USE OK TO OVERWRITE?	[yes]	
PLATE TO PLATE FILE STEP TO EDIT FILE #63		

4. Turn the WellPro off. Wait 20 seconds, and then turn it on. (You don't need to turn the WellPro off to store a file. It is done to demonstrate that the file is not lost when the WellPro is turned off.)
5. When the WellPro completes its self test, press [file], [3] [2], and the file, if you wish. If you have re-edited the file, press **[stop]** at END OF FILE.
6. Return to the beginning of the file, to remove the file from memory (Press **[stop]** twice).
7. From the top of the file, press **[file]** and **[clear]**. The display will read **YES TO DELETE FILE #32.**
8. Press **[yes]**. You may then move to another file.

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WellPro Files Used with the Standard Unit

File 0 Homing
File 61 Plate Filling
File 62 Serial Dilution
File 63 Plate-to-Plate Transfer
File 64 Empty-Fill Partial
File 65 Time Delay

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File Link

FILE LINK allows you to join stored files into a sequence, which enables you to automate complex liquid handling operations.

A file parameter, **LINK TO STORED FILE**, appears before the **END OF FILE** message. This prompt permits you to direct the WellPro to go to a particular stored file, immediately after completing the file that it is currently running.

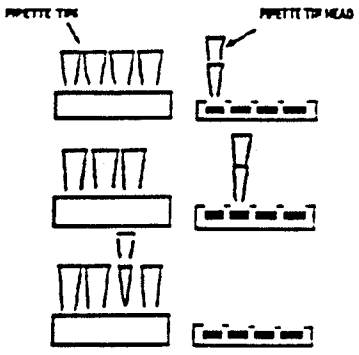
The **ENTER FIRST TIP ROW** prompt will appear, at the start of the first file in the sequence, when a linked sequence uses tips. This prompt will appear whether or not the tips are to be changed in the first file. Respond by specifying the row of tips (A-J, the standard , plus the tips for the microtrough container) that you want the WellPro to select first.

The WellPro uses the same counter to keep track of the tips that have been used, whether you have specified tip changes or not. Each time the WellPro links to the next file in a chain, it sequences through the tip magazine, to select the next row of fresh, uncontaminated tips. If you start a new file, or restart the same file, the counter will automatically increment, causing the WellPro to select the next row of unused tips.

When the last row of tips (row A) has been used, the WellPro will automatically stop, and, again, display the ENTER FIRST TIP ROW prompt. Change the magazine, and specify the starting row of tips (usually row H for the magazine, or row J, if you have, also, changed the tips for the microtrough container).

Here is an example of a linked file structure:

Let File 21 be a user-customized Serial Dilution file.

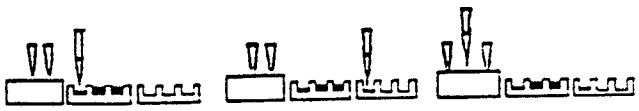


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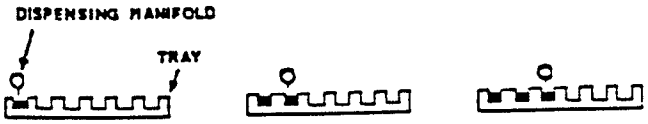
After the last dilution, File 21 will link to File 22, because it is linked by this statement (from file 21)

LINK TO STORED FILE
(0-45, 0=STOP) 22

File 22 might be a plate-to-plate transfer, which would take a small sample from the diluted plate. and distribute it to an assay plate.



After the WellPro had finished, it would link to File 34 (linked files don't have to be in any order, or even a continuous block of files).



In File 34, a statement indicates that this is the last file in the sequence. This statement is always expressed as

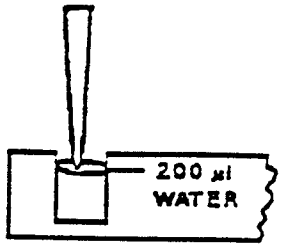
LINK TO STORED FILE
(0-45, 0=STOP) 0

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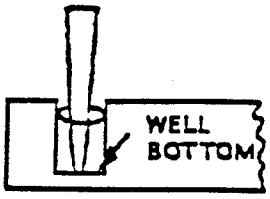
Tip Height

The depth of the tips in the wells must be properly set, for the WellPro to run accurately during an aspiration or delivery step. When standard microplates are used, this depth is set, choosing one of the preset values: FLAT, U, or V, offered in the PLATE TYPE PARAMETER. When using microtitration plates, other than standard microplates, and in special situations, you will need to set the tip height. Use the settings that you determine from this file.

The following figures illustrate the height positions that this file provides:



Important Height Values



FILE SEVENTY

TIP HEIGHT
START TO RUN FILE #70

[START]

SELECT FUNCTION
TIPS - WASH HEAD

TIP NOW AT 1100
(20 - 3500) GO TO ___

TIP HEIGHT
COMPLETE FILE #70

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WellPro Parameters

CHANGE TIPS: specifies whether to get new tips, from the tip magazine, for each row, during the dilution/fill/transfer cycle. If you don't change tips, the WellPro will use the same set of tips, throughout the entire file.

DELAY: tells the WellPro to wait a specified interval, before beginning the next file in a linked sequence. Delay can be set for 0 to 999 minutes and 0 to 59 seconds. Enter the minutes, press [ENTER], then enter seconds.

DELIVER FROM: specifies where the solution is delivered from. Set the value to T1, T2, T3, PUMP, or ABO/Rh to indicate the front (T1), middle (T2), and rear (T3) reservoirs of a microtrough container, the peristaltic pump (with optional dispense head), or the single pipette head for the carousel.

DELIVERY VOLUME: specifies how much solution to dispense into each well from the microtrough reservoir or the peristaltic pump. Set the value from 0 to 200µL, in 1µL increments, when filling from the microtrough reservoir, and from 25 to 350µL, when filling from the dispense manifold pump.

DESTINATION ROWS: specifies which rows of the **destination** plate will receive samples from the source plate. This parameter appears if the **1 to SEVERAL** mode is selected. One, several, or all of the rows of the destination plate may be specified to receive samples from the source plate.

EMPTY LAST ROW TO: specifies where to place the extra volume of liquid transferred into the last row of wells after a serial dilution.

- OFF leaves the extra liquid in the last row of wells.
- 1ST ROW removes the transfer liquid from the last row of wells, and returns it to the first row of wells specified in the **rows to dilute parameter**.
- MAG tells the WellPro to remove the extra liquid, and discard it into the tip magazine.
- **TROF3** will be displayed if the PLATE ORIENTATION is 12 way. **TROF3** tells the WellPro to remove the extra liquid, and discard it into the rear reservoir of a microtrough container, located in the P2 position of the template.

END OF FILE: tells the WellPro to execute a file (RUN) or store the file in memory (STORE), after you edit a file. You can review the file with the [STEP] key.

ENTER FIRST TIP ROW: specifies which row of tips to start with. Rows of the tip magazine are designated by letters **A through J** (back to front). 12 way templates use A-H, 8 way use A-J. The extra two rows of tips on the microtrough container are designated by I and J (back to front).

FILL PLATE ROWS: specifies which rows of the plate to fill, and which to leave unfilled. Rows are designated by letters A through H.

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LEAVE WELLS FILLED: tells the optional Pro/WASH system whether to drain the wells after washing. Select NO to drain the wells after the last wash. Select YES, to soak the entire plate, after washing. YES, causes the wash head to raise, just before the vacuum comes on. The wells will remain filled for soaking, and allow linkage with the Time Delay File.

LINK TO STORED FILE: allows users to link files to previously stored files, while editing files. The entry of a file number directs the WellPro to execute the specified file, on completion of running the current file. A value of 0 indicates the end of an independent file, or the end of a sequence of files. This value will cause the WellPro to stop, once it has finished running the current file. The WellPro will cycle back to the start of the first file in a sequence, for easy restart, after it completes the last file in a sequence,. The LINK TO STORED FILE parameter permits more efficient operation, because you don't need to start each individual file manually with the [file], file number, [enter], [start] key sequence

LIQUID HANDLING SPEEDS: specifies whether sample delivery from the tips or manifold should be rapid, medium, or slow.

MIXES BEFORE AND AFTER TRANSFER/EMPTY: specifies how many mixes to perform, before transferring a sample. Set the value from 0 to 9, in increments of 1. 0 indicates no mixing.

MIXES BEFORE EMPTY: specifies how many mixes to perform during the mixing process, **before** waste removal. Set the value of this parameter from 0 to 9 mixes, in increments of 1. 0 indicates no mixing.

MIXES IN TROF: specifies mixing of the trough contents. Set the value from 1 to 9, in increments of 1. 0 indicates no mixing.

MIX VOLUME: specifies how much solution to add to the well The value can be set in 1µL increments, from 0µL to an upper limit of 75% of the well. The WellPro will automatically calculate and display this upper limit value.

MIX VOLUME EMPTY: specifies how much liquid from each well to aspirate into the same well, to mix the solution. This is done **before** the solution is removed, during the emptying operation. The value of may be set to exceed 75% of the total volume in the well you are mixing, by using the [help] key. The WellPro automatically calculates this amount, and indicates it on the display, as the upper limit. You can set the value of mix volume in 1µL increments from 0µL to the upper limit. 0 indicates no mixing.

NUMBER OF WASHES: tells the optional Pro/WASH system how many soak-wash cycles to perform. You can set this value from 0 to 9, in increments of 1.

PAUSE WHEN LINKING: specifies whether to pause and await restart after operator attention, or whether to continue to the next file, without halting. This feature is useful for changing plates or tips, adding reagents, etc.

PLATE ORIENTATION: specifies 8 way (8 wells under the tips) or 12 way (12 wells under the tips) plate orientation.

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PLATE POSITION: specifies if the plate is in bed position P1 (the forward position), or P2 (the back position).

PLATE TYPE: specifies whether your plate has a flat, U-shaped, or V-shaped bottom. The WellPro uses this information to determine the height of the liquid in each well and how far down the tips should go, into the wells. If you are not using a standard microplate, set the height yourself with **height**. Determine the amount to raise or lower the tip height by using File 70, the Tip Height File. Set the value of **height** from 100 to 3500, in increments of 1.

PLEASE FILL TROF: appears on the display after you start or restart a file that calls for more transfers from the microtrough reservoir than the current volume can supply. The prompt allows you to enter the volume to add to the microtrough reservoir, without requiring you to step back through each of the file's parameters.

RINSE VOLUME AFTER SOAK: specifies how much wash solution is delivered into each well after soaking, to rinse the well and the wash capillaries. The range is 0 to 9000, in 1µL increments. If you did not soak the plate after washing, this parameter will be bypassed.

ROWS TO DILUTE: specifies which plate rows to include in the serial dilution. Rows are designated by letters A through H (back to front) in the 12 way configuration, and 1 through 12 in the 8 way configuration.

ROWS TO EMPTY: specifies which plate rows to empty. Rows are designated by letters A through H (back to front) in the 12 way configuration, and 1 through 12 in the 8 way configuration.

ROWS TO WASH: tells the optional Pro/WASH system which plate rows to empty and wash. Rows are designated by letters A through H (back to front) in the 12 way configuration, and 1 through 12 in the 8 way configuration.

SELECT FUNCTION: specifies whether you will be measuring plate dimensions for use with the Pro/Tips or optional Pro/WASH Plate Washing system.

SOAK TIME PER WASH: tells the Pro/WASH system how long to soak the plate before rinsing. The first part of this parameter sets the soaking time from 0 to 999 minutes, in increments of one minute. The second part of this parameter sets the soaking time from 0 to 59 seconds, in increments of one second. Setting both minutes and seconds to 0 indicates no soaking.
Keep hands away from Pro/WASH assembly during soak cycle. It may start again without warning.

SOURCE ROW: This parameter only appears if the **1 to SEVERAL** mode is selected. It specifies which row of the source plate to use for withdrawing samples. The **source** row will be single source row for transfer to several **destination** (receiving) rows.

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TIP NOW AT: Used to raise or lower the tips. TIPS NOW AT bring the tips into a position that approximates the one you are trying to determine. Set this parameter in increments of 1 from 20 to 3500, with each step being equivalent to lowering the tip by approximately 0.00124 inch. Use the [↑] OR [↓] keys to raise or lower the tips ten steps at a time (0.0124 inch) to fine adjust the position of the tips.

TRANSFER DIRECTION: specifies whether to transfer from P2 to P1 or from P1 to P2. You can designate either P1 (the plate in the front position of the template) or P2 (the plate in the middle position) as the source plate.

TRANSFER MODE: specifies whether to transfer one row of plate 1 to the corresponding row of plate 2, **or** to transfer one row of plate 1 to several different or multiple rows of plate 2.

TRANSFER MODE/DIRECTION: Allows you to use a 96 well plate as a reagent trough, to deliver multiple reagents to a single assay plate. You can place the same or different reagents in each of the twelve columns, and/or each of the eight rows of the source plate. These reagents can be delivered to specified rows on the destination plate. This arrangement minimizes reagent waste, especially if you are using a V-bottomed plate.

When you use TRANSFER MODE/DIRECTION feature with the TUBE HANDLING feature option, you can carry out transfers from larger containers such as micro test tubes or segmented troughs, and use them as reagent containers. Using the [help] key enables you to extend the acceptable range for TRANSFER VOLUME and VOLUME IN WELL AT START, so you can make full use of the larger volume capacity of these containers.

TRANSFER ROWS: specifies which rows of the source plate to transfer to the corresponding (i.e. A to A, B to B, etc.) rows of the destination plate. This parameter only appears if the **1 to 1** mode is selected.

TRANSFER VOLUME: specifies how much sample to withdraw from the original well, for transfer to the new well, during a serial dilution. Set the value from 0 to 200µL, in 1µL increments. A transfer volume of 0 may be used, to mix the contents of the well.

TROF MIX VOLUME: specifies how much liquid to aspirate into the tip and dispense back into the trough, to mix the trough contents. Set the value from 0-200, in 1µL increments. 0 indicates no mixing. Mix efficiency may vary with trough volume.

TROF VOLUME AT START: appears if you are filling your plates from a microtrough. TROF VOLUME AT START specifies how much liquid is in the reservoir you have chosen, before any liquid has been removed. The WellPro automatically calculates the minimum volume needed to run the file and indicates it on the display as the lower limit, using the delivery volume and the number of rows to be filled,. Set the value in 1 ml increments, from this lower limit to 20 ml, 60 ml, or 80 ml for the front, middle, and rear reservoirs respectively. After running the file, the WellPro controller will change the value to reflect the decreased amount of liquid in the reservoir.

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VOLUME IN WELL AT START: specifies how much liquid is in each well, before any transfer has been made. The WellPro uses this value to determine how far down into the wells the tips should go, and to prevent the instrument from attempting to add more liquid than each well can hold. Set the value of this parameter from 0 to 350µL, in 1µL increments.

VOLUME IN WELL PLATE 1 OR PLATE 2: specifies how much liquid is in each well of plate 1 or plate 2. The WellPro uses this value to determine how far down into the wells the tips should go, and to prevent exceeding the volume capacity of the wells. Set the value from 0 to 350µL, in 1µL increments.

VOLUME TO EMPTY: specifies how much liquid to remove from each well and transfer to the waste container: a reservoir of the microtrough container. Set the value of this parameter from 0 to 200µL, in 1µL increments.

WASH VOLUME BEFORE SOAK: tells the Pro/WASH system how much wash solution to deliver into each well, for the washing process. Set the value from 0 to 9000µL, in 1µL increments.

WASTE TO TROF: specifies which reservoir of the microtrough container will receive the waste solution. Set the value to T1, T2, or T3, the front (1), middle (2), and rear (3) reservoirs.

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Plate Filling

The WellPro can fill a maximum of two plates, from a microtrough reservoir, or the optional reservoir 12-channel manifold.

For accurate and precise filling, use tips and the microtrough reservoir. The WellPro can be set to take liquid from the reservoirs of the microtrough. For more rapid filling, with slightly less accuracy, use the optional 12-channel manifold.

Here are the basic steps that the WellPro takes to fill a microtitration plate:

1. Aspirate sample from a reservoir.
2. Dispense to the plate.
   or
   Use the manifold, to fill a plate directly.

The following sequence of parameters will appear on the WellPro display. You can change the value of each parameter, for great flexibility in filling plates.

FILE SIXTY-ONE

PLATE FILLING
STEP TO EDIT FILE # 61

PLATE POSITION
1 - 2 - BOTH

VOL IN WELL AT START
(0-350) 0ul

DELIVER FROM
T1 - T2 - T3 - PUMP

MIXES IN TROF
(0-9) 3

TROF MIX VOLUME
(0-200) 200ul

DELIVERY VOLUME
(0-200) 100ul

MIXES AFTER TRANSFER
(0-9) 2

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MIX VOLUME
(0-75) 75ul

PLATE TYPE
FLAT-U-V-HEIGHT-TUBE

FILL PLATE ROWS
A-B-C-D-E-F-G-H

TROF VOL AT START
(20-80) ..... 77 ml

CHANGE TIPS?
YES-NO

LIQ HANDLING SPEEDS
RAPID-MEDIUM-SLOW

LINK TO STORED FILE
(0-45, 0=STOP) 0

END OF FILE
RUN-STORE

ENTER FIRST TIP ROW
(A-J) ..... H

Note: If Plate Position **BOTH** is selected, a trough is placed in P3, and tip rows A or B are used.

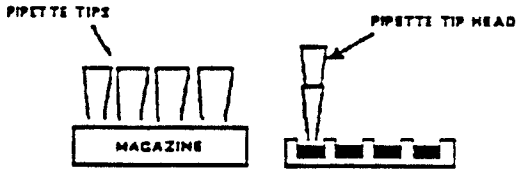
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Serial Dilution

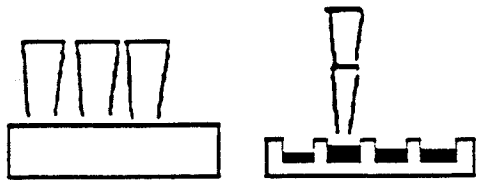
Serial dilution is the progressive redilution of a liquid. In this process, a sample is added to a diluent, mixed, and a sample aliquot removed, for addition to the next diluent-containing well. This sequence is repeated, until a series of dilutions has been obtained. The series contains a sequential lowering of the sample's concentration. If equal volumes of sample and diluent are mixed, during each step of the series, the, sample concentration would be 1:2, 1:4, 1:8, 1:16, 1:32, etc..

This exercise illustrates the basic steps that the WellPro takes to perform a serial dilution.

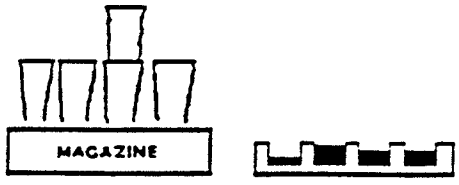
1. Aspirate sample.



2. Deliver sample, to dilute well and mix contents.



3. Replace used tip with fresh one, and repeat for next pair of rows.



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FILE SIXTY-TWO

SERIAL DILUTION
STEP TO EDIT FILE #62

VOL IN WELL AT START
(0-350) 100 ul

TRANSFER VOLUME
(0-100) ..... 50 ul

MIXES BEFORE TRANSFER
(0-9) 3

MIX VOLUME
(0-75) ..... 75 ul

CHANGE TIPS?
YES-NO

PLATE TYPE
FLAT-U-V-HEIGHT-TUBE

PLATE ORIENTATION
12-8 WELLS ACROSS

ROWS TO DILUTE
A-B-C-D-E-F-G-H

EMPTY LAST ROW TO
OFF-1ST ROW-MAG-TROF 3

LIQ HANDLING SPEEDS
RAPIDS-MEDIUM-SLOW

LINK TO STORED FILE
(0-45, 0=STOP) 0

END OF FILE
RUN-STORE

ENTER FIRST TIP ROW
(A-J) H

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File 62: Serial Dilution: 1:2 Ratio

This example demonstrates how to perform a serial dilution on 100µL samples, in an 8 way, flat bottom micro plate

1. Fill an empty plate with 100µL of distilled water.
2. Place an 8 way template on the table.
3. Place the tip magazine in the back position (P2) of the template.
4. Manually pipette 100µL samples into row 1 of the plate.
5. Place the plate in the front position of the template with samples.
6. Press **[file]**, **[6]** **[2]**, and **[enter]**, to access File 62.
7. Edit the file, using the following keystrokes:

Display Before Editing	Keystrokes	Display After Editing
SERIAL DILUTION STEP TO EDIT FILE #62	[step]	
VOL IN WELL AT START (0-350) 100 ul..	[step]	VOL IN WELL AT START (0-350) 100 ul
TRANSFER VOLUME (0-50) 50 ul....	[step]	TRANSFER VOLUME (0-50) 50 ul
MIXES BEFORE TRANSFER (0-9) 3	[step]	MIXES BEFORE TRANSFER (0-9) 3
MIX AFTER TRANSFER (0-9) 3	[step]	MIX AFTER TRANSFER (0-9) 3
MIX VOLUME (0-37) .....37 ul	[step]	MIX VOLUME (0-37) 37 ul
CHANGE TIPS? YES-NO	[step]	CHANGE TIPS? YES-NO

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PLATE TYPE FLAT-U-V-HEIGHT-TUBE	[no] [step]	PLATE TYPE FLAT-U-V-HEIGHT-TUBE
PLATE ORIENTATION 12-8 WELLS ACROSS	[no] [step]	PLATE ORIENTATION 12-8 WELLS ACROSS
DILUTE ROWS 1-2-3- 4-5-6-7-8-9-10-11-12....	[step]	DILUTE ROWS 1-2-3- 4-5-6-7-8-9-10-11-12
EMPTY LAST ROW TO OFF-1ST ROW-MAG-TROF3	[step]	EMPTY LAST ROW TO OFF-1ST ROW-MAG-TROF3
LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW	[step]	LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW
LINK TO STORED FILE (0-45, 0=STOP) 0	[step]	LINK TO STORED FILE (0-45, 0=STOP) 0
END OF FILE RUN-STORE	[enter]	
SERIAL DILUTION START TO RUN FILE #62	[start]	

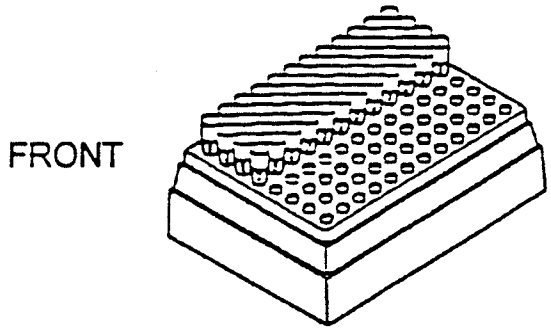
Serial dilutions can be some of the most cumbersome and time consuming liquid handling operations, when performed manually. The WellPro has the capability to perform complex serial dilution sequences. As you gain familiarity with the file linking features, experiment with the range of possible sequences, to customize your own serial dilution files.

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File 62: Serial Dilution: Skip Columns

This example demonstrates how to perform a simple 1:2, 1:4, 1:8, 1:16, etc. serial dilution, on 50µL samples, in the four left-hand columns of an 8 way, U-bottomed, microtitration plate, while changing tips. Each well of the plate will be prefilled with 50µL of solution, from the pump, and there will be four 50µL mixes, after sample has been delivered to each well.

1. Place a plate in the P1 position of a 12 way template.
2. Fill rows 1 through 4 of a plate with 50µL of diluent, modifying the instruction given in the PLATE FILLING: FROM PUMP example as necessary (VOL IN WELL AT START = [step]; FILL ROWS PLATE 1 = [yes] [yes] [yes] [yes] [no] [no] [no] [no] [step]).
3. Place an 8 way template on the table.
4. **Remove all the tips from the four right-hand columns in the magazine.** You will be using the magazine in 8 way fashion.



Blocking out tip magazine

5. Place the magazine of tips in the back position of the template, with the tips on the left side.
6. Manually pipette 50µL samples into the four right-hand prefilled wells of row 1 of the plate (wells A12, B12, C12, D12).
7. Place the plate, with samples facing the back of the instrument, in the front position of the template.
8. Press **[file], [6] [2], [enter],** to access File 62.
9. Edit the file, using the keystrokes shown in the FILE 62; SERIAL DILUTION 1:2 example..
10. Press **[start]** and **[enter],** to run the file.

Notes:
Partial rows and/or columns can be run this fashion, during plate fills, serial dilutions, plate to plate transfers, plate empties, and plate washes. Experiment with variations of this example, to observe how the variations can be used to block out columns or partial rows on the plate. This is an important feature. It allows you to establish undisturbed areas of the plate for controls, etc. Consider this possibility, when designing new, complex assays.

If you select a 12 way plate orientation, for your serial dilutions, you will need to use the 12 way template. Place the plate, with samples facing the back of the instrument, in the front position of the template.

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File 63: Plate-to-Plate Transfer Mode and Direction

This example demonstrates transfer mode capability. The example uses 35µL of water (sample simulate), and allows you to specify either plate as the source or destination plate.

In this example, both plates are flat-bottomed 96 well standard microplates. To transfer from row B of plate 1 to rows C and D of plate 2:

1. Install the 12 way template.
2. Place a magazine of tips in P3, the back position of the template.
3. Place an empty plate in the front position of the template. This will be the source plate.
4. Pipette 100µL of distilled water to row B of the source plate.
5. Place an empty plate in the middle position of the template. This will be the destination plate, plate #2.
6. Press **[file], [6] [3],** and **[enter],** to access File 63.
7. Edit the file, using the following keystrokes:

Display Before Editing	Keystrokes	Display After Editing
PLATE TO PLATE STEP TO EDIT FILE #63	[step]	
TRANSFER DIRECTION P2 TO P1 - P1 TO P2	[no] [enter]	TRANSFER DIRECTION P2 TO P1 - P1 TO P2
VOL IN WELL PLATE 1 (0-350) 100 ul	[step]	VOL IN WELL PLATE 1 (0-350) 100 ul
VOL IN WELL PLATE 2 (0-350) 0 ul	[step]	VOL IN WELL PLATE 2 (0-350) 0 ul
TRANSFER MODE	[step]	1 TO 1-1 TO SEVERAL
SOURCE ROW A-B-C-D-E-F-G-H	[no] [enter]	SOURCE ROW A-B-C-D-E-F-G-H
DESTINATION ROWS A-B-C-D-E-F-G-H	[no] [no] [yes] [yes] ; [no] [no] [no] [no] [enter]	DESTINATION ROWS --C-D----

In the next step, the controller will automatically calculate the acceptable range of the TRANSFER VOLUME, by dividing the VOL IN WELL PLATE 1 (100µL) by the number of rows that will receive a transfer (rows C and D). The maximum acceptable volume for the transfer is 50µL.

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TRANSFER VOLUME (0-50) 50 ul	[3] [5] [enter]	TRANSFER VOLUME (0-50) 35 ul
MIXES BEFORE TRANSFER (0-9) 0	[step]	MIXES BEFORE TRANSFER (0-9) 0
MIXES AFTER TRANSFER (0-9) 0	[step]	MIXES AFTER TRANSFER (0-9) 0
CHANGE TIPS? YES-NO	[step]	CHANGE TIPS? YES-NO
PLATE 1 TYPE FLAT-U-V-HEIGHT-TUBE	[step]	PLATE 1 TYPE FLAT-U-V-HEIGHT-TUBE
PLATE 2 TYPE FLAT-U-V-HEIGHT-TUBE	[step]	PLATE 2 TYPE FLAT-U-V-HEIGHT-TUBE
LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW	[step]	LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW
LINK TO STORED FILE (0-45, 0=STOP) 0	[step]	LINK TO STORED FILE (0-45, 0=STOP) 0
END OF FILE RUN-STORE	[step]	
PLATE TO PLATE START TO RUN FILE #63	[start]	

The WellPro allows you to create and store multiple versions of File 63: Plate-to-Plate Transfer, so that you can transfer from row A of plate 1 to rows A and B of plate 2, from row B to rows C and D, from row C to rows E and F, from row D to rows G and H, and, then, link these files together. The result is that you can transfer from the rows of one plate to duplicate rows of another plate, for assay, using a single [start] keystroke. Details on linking are provided in subsequent examples.

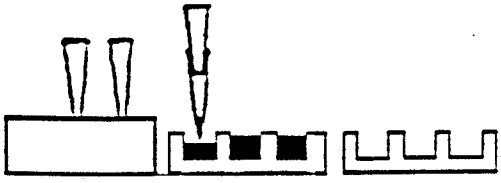
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Plate-to-Plate

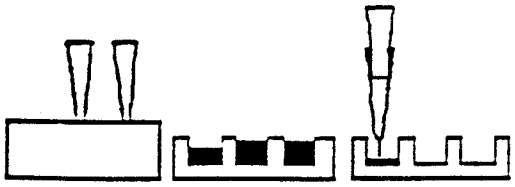
Plate-to-plate transfer (replica plating) is the transfer of an aliquot of sample from one plate to another. Groups of samples in a **source** plate can be transferred to a **destination** plate for assay, culture, etc.

Here are the basic steps that the WellPro takes, to perform the plate transfer:

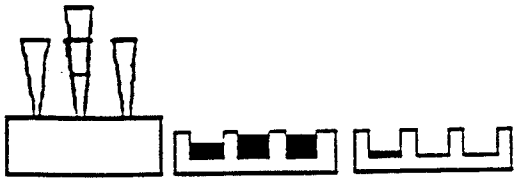
1. Aspirate sample from source plate. (which is plate #2 shown here)



2. Deliver sample to receiver plate.



3. Replace used tip with fresh one and proceed to next sample row, etc.



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This sequence will appear on the display. You can change the value of each parameter, for flexibility in your dilution ratios.

FILE SIXTY-THREE

PLATE TO PLATE
STEP TO EDIT FILE #63

TRANSFER DIRECTION
P2 to P1 - P1 to P2

VOL IN WELL PLATE 1
(0-350) ..... 0 ul

VOL IN WELL PLATE 2
(0-350) ..... 100 ul

TRANSFER MODE
1 TO 1-1 TO SEVERAL

TRANSFER VOLUME
(0-200) ..... 50 ul

MIXES BEFORE TRANSFER
(0-9) 0

MIXES AFTER TRANSFER
(0-9) 0

MIX VOLUME
(0-75) ..... 75 ul

CHANGE TIPS?
YES-NO

PLATE 1 TYPE
FLAT-U-V-HEIGHT-TUBE

PLATE 2 TYPE
FLAT-U-V-HEIGHT-TUBE

SOURCE ROW
A-B-C-D-E-F-G-H

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TRANSFER ROW
A-B-C-D-E-F-G-H

DESTINATION ROWS
A-B-C-D-E-F-G-H

LIQ HANDLING SPEEDS
RAPID-MEDIUM-SLOW

LINK TO STORED FILE
(0-45, 0=STOP) 0

END OF FILE
RUN-STORE

ENTER FIRST TIP ROW
(A-H) #H

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Transfer Mode/Direction

Transfer mode/direction extends the range of alternatives for File 63: Plate-to-Plate Transfer, by allowing you to define one or more **destination** rows, on one plate, for each **source** row on another plate. You can:

- transfer any single row in one plate to any other single row in another plate.

or

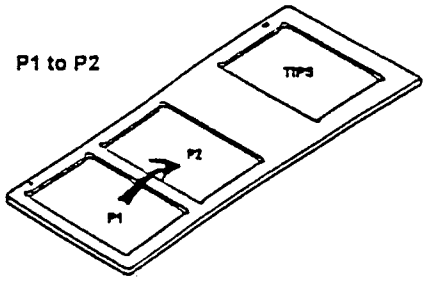
- transfer any single row in one plate to two or more rows in another plate.

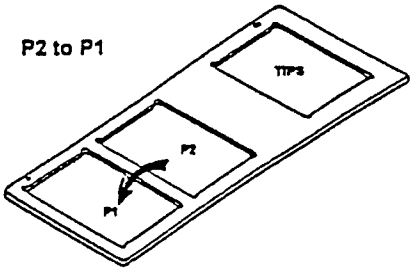
You can, also, specify the direction of the transfer. The default direction is from P2 to P1, but you can direct the WellPro to make the transfer from P1 to P2, instead. This allows you to designate either plate as the destination plate.

You can transfer from row A of plate 1 to row B of plate 2. Likewise, you can transfer from row A of plate 2 to rows A, B, and C of plate 1. This enables you to set up an assay plate to do duplicates, triplicates, etc.

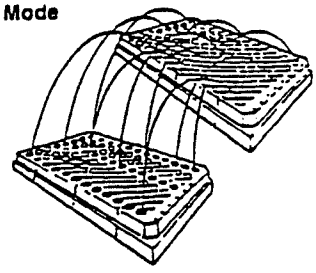
The WellPro calculates the maximum transfer volume for the row, by dividing the **volume in well at start** by the number of transfers specified for that row.

The **transfer mode/direction** feature is particularly useful, when combined with **file link**, because it allows you to transfer duplicate samples from the rows of one plate to another plate. If you use these functions in combination, it is possible to transfer from row A of plate 1 to rows A and B of plate 2, then, automatically continue with another file, which transfers from row B of plate 1 to rows C and D of plate 2, and so on.

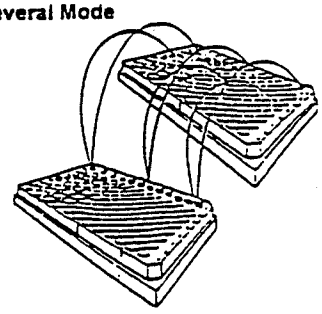




Single Mode



1 to Several Mode



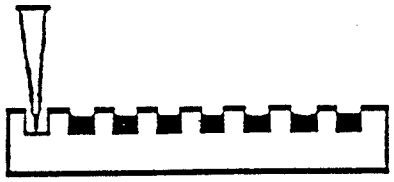
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Plate Empty

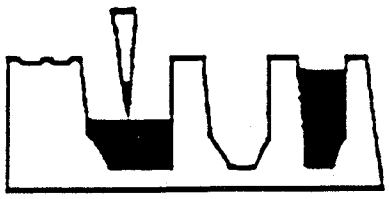
The WellPro can remove all or part of the solution in a microtitration plate, and replace it with another solution. This second solution can be delivered from a microtrough reservoir or the, optional, 12-channel manifold. Use this file to make rapid exchanges of culture media, reagents, diluents, etc., within a single plate. For refilling with a new reagent, link to an edited FILE # 61, plate fill file.

These are the basic steps that the WellPro takes to empty a microtitration plate:

1. Aspirate sample from plate.



2. Deliver to T3 waste reservoir.



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FILE SIXTY-FOUR

PLATE EMPTY
STEP TO EDIT FILE # 64

VOL IN WELL AT START
(0-350) ..... 250 ul

VOLUME TO EMPTY
(0-200) ..... 200 ul

WASTE TO TROF
T1-T2-T3

CHANGE TIPS
YES-NO

PLATE TYPE
FLAT-U-V-HEIGHT-TUBE

MIXES BEFORE EMPTY
(0-9) 0

ROWS TO EMPTY
A-B-C-D-E-F-G-H

LIQ HANDLING SPEEDS
RAPID-MEDIUM-SLOW

LINK TO STORED FILE
(0-45, 0=STOP) 0

END OF FILE
RUN-STORE

ENTER FIRST TIP ROW
(A-J) H

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File 70: Tip Height

This example demonstrates how to determine the two numbers required to edit a file, so that a nonstandard microplate can be used for microtitration.

1. Place a 12 way template on the table.
2. Place the magazine in the back position of the template (P3).
3. Fill row H, of a microtitration plate, with 200µL of water.
4. Place the plate in the middle position of the template.
5. Press [file], [7] [0], and [enter], to access File 70.
6. Press [start].
7. When **TIP NOW AT XXXX** is displayed, press [2] [8] [0] [0] and [enter], to bring the tips down to the plate.
8. Press the [↑] (yes) or [↓] (no) keys to raise or lower the tips, until they just touch the meniscus of the water. Record the **TIP NOW at** number on a photocopy of the Tip Height Worksheet, as the **200µL Height**.
9. Press the [↓] (no) key, or enter numbers until the tips are just above the bottom of the wells. Record the **TIP NOW at** number on the worksheet, as the **WELL BOTTOM HEIGHT**.
10. Press the [stop] key, and the display will read **TIP HEIGHT-COMPLETE FILE #70**.
11. Press [file], the unique file number that you will assign, and [enter].

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File 64: Empty-Fill Partial

This example demonstrates how to:

- Empty part of the contents (75µL of the 100µL) of a nonstandard microtitration plate.
- Discard the waste into the rear reservoir of a microtrough container.
- Refill each well with 75µL from the pump.

The water, in this example, represents culture media above cells, which need to be exchanged with fresh media. The cells should not be resuspended during the emptying process, so slow liquid-handling speeds will be used. Tips will be changed during the emptying process, and refilling will be done from the pump, to prevent contamination of the wells.

The plate, in this example, is not a standard microplate. You will need to use File 70, to determine the 200µL and well-bottom heights, to enter into this file. You will need to link two files to accomplish this task: one file to empty the waste reagent, and a second file, to refill the plate.

1. Place a 12 way template on the table.
2. Place a flat-bottomed plate (to represent a plate that is not a standard microplate) in the middle position of the template.
3. Press **[file] [7] [0]** and **[enter],** to access File 70.
4. Enter the File 70 parameters, to determine the 200µL HEIGHT and the WELL BOTTOM HEIGHT.
5. At the end of File 70, place a new plate in the middle position (P2) of the template. Press **[file] [6] [1],** and **[enter],** to access File 61.
6. Fill the plate with 100µL of water, from the pump. Modify the FILE 61: PLATE FILLING FROM PUMP example (VOL IN WELL AT START = [step]; DELIVERY VOLUME = [1] [0] [0] [enter]; PLATE TYPE = [step]).
7. Place the filled plate in the front position of the template.
8. Place a magazine of tips in the back position of the template.
9. Place a microtrough container in the middle position of the template.
10. Press **[file], [6] [4],** and **[enter]** to access File 64.
11. Edit the file, using the following keystrokes:

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Display Before Editing	Keystrokes	Display After Editing
PLATE EMPTY STEP TO EDIT FILE # 64	[step]	
VOL IN WELL AT START (0-350) 200 UL	[1] [0] [0] [enter]	VOL IN WELL AT START (0-350) 100 ul
VOLUME TO EMPTY (0-100) 200 UL	[7] [5] [enter]	VOLUME TO EMPTY (0-100) 75 ul
WASTE TO TROF T1-T2-T3	[step]	WASTE TO TROF T1-T2-T3
CHANGE TIPS YES-NO	[step]	CHANGE TIPS YES-NO
PLATE TYPE FLAT-U-V-HEIGHT-TUBE	[no] [no] [no] [step]	PLATE TYPE FLAT-U-V-HEIGHT-TUBE
WELL BOTTOM HEIGHT (100-3500) 100	####; [enter]	WELL BOTTOM HEIGHT (100-3500) ####
200 ul HEIGHT (0-####) 0	XXXX; [enter]	200 ul HEIGHT (0-####) XXXX
MIXES BEFORE EMPTY (0-9) 0	[step]	MIXES BEFORE EMPTY (0-9) 0
ROWS TO EMPTY A-B-C-D-E-F-G-H	[step]	ROWS TO EMPTY A-B-C-D-E-F-G-H
LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW	[no] [step]	LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW
LINK TO STORED FILE (0-45; 0=STOP) 0	[3] [1] [enter]	LINK TO STORED FILE (0-45; 0=STOP) 31
END OF FILE RUN-STORE	[no] [enter]	
FILE STORE ENTER USER #	[1] [2] [3] [4] [enter]	
FILE STORE ENTER FILE #1	[3] [0] [enter]	

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YES TO STORE [yes]
USER #1234; FILE 30

PLATE EMPTY
STEP TO EDIT FILE 64

The preceding file will partially empty the contents of the specified wells. Link the newly created file to the following file, to refill the plate with new reagent.

Display Before	Keystrokes	Display After Editing
PLATE FILLING STEP TO EDIT FILE #61	[step]	
PLATE POSITION 1 - 2	[step]	PLATE POSITION 1 - 2
VOL IN WELL AT START (0-350) 0 UL	[2] [5] [enter]	VOLUME IN WELL AT START (0-350) 25 UL
DELIVER FROM T1-T2-T3-PUMP	[enter]	DELIVER FROM T1-T2-T3-PUMP
DELIVER VOLUME (25-325) 200 UL	[7] [5] [enter]	DELIVERY VOLUME (25-325) 75 UL
PLATE TYPE FLAT-U-V-HEIGHT-TUBE	[step]	PLATE TYPE FLAT-U-V-HEIGHT-TUBE

(NOTE: **If tips are not used**, the pump does not require precise plate height dimensions. They may be omitted from plate filling files.

FILL PLATE ROWS A-B-C-D-E-F-G-H	[step]	FILL PLATE ROWS A-B-C-D-E-F-G-H
LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW	[no] [step]	LIQ. HANDLING SPEEDS RAPID-MEDIUM-SLOW
LINK TO STORED FILE (0-45, 0=STOP) 0	[step]	LINK TO STORED FILE (0-45, 0=STOP) 0
END OF FILE RUN-STORE	[no] [step]	
FILE STORE ENTER USER #	[1] [2] [3] [4] [enter]	

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FILE STORE [3] [1] [enter]
ENTER FILE # 1

YES TO STORE [yes]
STEP TO EDIT FILE 61

Next, prime the peristaltic pump and manifold, if that hasn't been done (see File 0: Homing and Priming). Access file 30 (the first file in the empty-fill sequence), and place the plate and microtrough container onto the template. Start the sequence, and observe the link to the subsequent filling file.

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File 64: Empty Complete Contents

This example demonstrates how to:

- Empty the entire contents (100µL) of each well of a nonstandard microtitration plate.
- Discard the waste into the rear reservoir (T3) of a microtrough container.

The plate, in this example, is a nonstandard microplate. Use File 70, to determine the 200µL and well-bottom heights to use with this file.

1. Place a 12 way template on the table.
2. Place a U-bottomed plate (to represent a non-standard microplate) in the middle position of the template.
3. Press **[file] [7] [0]** and **[enter]**, to access File 70.
4. Enter the file 70 parameters, to determine the 200µL HEIGHT and the WELL BOTTOM HEIGHT. The TIP HEIGHT FILE example, in this section, will show you how to use the file.
5. At the end of File 70, press **[file]**, **[6][1]**, **[enter]** to access File 61.
6. Fill the plate with 100µL of water, from the pump. Modify FILE 1: PLATE FILLING FROM PUMP example.
7. Place the plate in the front position of the template.
8. Place a magazine of tips in the back position of the template.
9. Place the microtrough container in the middle position of the template.
10. Press **[file]**, **[6] [4]**, and **[enter]**, to access File 64.
11. Edit the file, using the following keystrokes:

Display Before Editing	Keystrokes	Display After Editing
PLATE-EMPTY STEP TO EDIT FILE # 64	[step]	
VOL IN WELL AT START (0-350) 200 ul	[1] [0] [0] [enter]	VOL IN WELL AT START (0-350) 100 ul
VOLUME TO EMPTY (0-100) 200 ul	[1] [0] [0] [enter]	VOLUME TO EMPTY (0-100) 100 ul
WASTE TO TROF T1-T2-T3	[step]	WASTE TO TROF T1-T2-T3
CHANGE TIPS YES-NO	[no] [step]	CHANGE TIPS YES-NO
PLATE TYPE FLAT-U-V-HEIGHT-TUBE	[no] [no] [no] [step]	PLATE TYPE FLAT-U-V-HEIGHT-TUBE

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WELL BOTTOM HEIGHT (100-3500) 100	####; [enter]	WELL BOTTOM HEIGHT (100-3500) ####
200 ul HEIGHT (0-####) 0	[enter]	200 ul HEIGHT (0-####) XXXX
MIXES BEFORE EMPTY (0-9) 0	[3] [enter]	MIXES BEFORE EMPTY (0-9) 3
MIX VOLUME EMPTY (0-75) 75 ul	[step]	MIX VOLUME EMPTY (0-75) 75 ul
ROWS TO EMPTY A-B-C-D-E-F-G-H	[step]	ROWS TO EMPTY A-B-C-D-E-F-G-H
LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW	[step]	LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW
LINK TO STORED FILE (0-45; 0=STOP 0	[step]	LINK TO STORED FILE (0-45, 0=STOP) 0
END OF FILE RUN-STORE	[enter]	
PLATE EMPTY-FILL START TO RUN FILE #64	[start]	
ENTER FIRST TIP ROW (A-3) ..... H	[enter]	

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Time Delay File

Time Delay allows you to insert a delay between two linked files. Extremely long periods can be created by linking two or more delay files in sequence, to fully automate the liquid handling portions of assays.

The display will show the remaining time, when time delay files are running.

Time Delay allows you to insert a delay between two linked files. The time delay can range from 1 second to sixteen hours (999 minutes), expressed in minutes and seconds. You can increase the period, by linking files in sequence, to fully automate the liquid handling portions of assays.

The display will show the remaining time, when time delay files are running.

You can direct the WellPro to add one reagent, wait a specified period of time, and add another reagent. You can, also, use a plate-to-plate transfer, to start a reaction, pause to incubate, and, then, use a plate fill operation to stop the reaction.

These are the parameters that appear on the WellPro controller display. (While this file is running, the display will show the remaining time).

FILE SIXTY-FIVE

TIME DELAY
STEP TO EDIT FILE #65

DELAY
(0-999) 0 MINS 0 SEC

DELAY
(0-99) 0 MIN 0 SEC

PAUSE WHEN LINKING
NO-YES

LINK TO STORED FILE
(0-45, 0 = STOP) 0

END OF FILE
RUN-STORE

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File Directory

The File Directory is used to locate and review stored files.
This example demonstrates how to:

- Store unedited files under various operator or project numbers.
- Search, sequentially, through the list, by file number, then by file type (e.g. Serial Dilution File, Plate to Plate File), and, finally, by operator or project identification number.

1. Use the STORING A FILE: OTHER THAN FIRST AVAILABLE LOCATION example to access and store the following unedited files:

PLATE TO PLATE
USER #1234 FILE #12

PLATE TO PLATE
USER #4567 FILE #14

PLATE TO PLATE
USER #28 FILE #37

SERIAL DILUTION
USER #28 FILE #32

SERIAL DILUTION
USER #1234 FILE #45

PLATE EMPTY FILL
USER #1234 FILE #22

PLATE EMPTY FILL
USER #4567 FILE #17

2. Press **[file]** and **[enter]** to access the File Directory. The display will show:

FILE DIRECTORY
ALL - BY TYPE - BY USER

3. Press **[enter]**, to search through **all** of the files that have been stored. When the display shows the following text, press **[1]** and **[enter]**, to start searching for file 1.

FILE DIRECTORY
ENTER FIRST FILE #

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4. This will be the next display:

PLATE TO PLATE
USER #1234 FILE #12

5. Press [step] after each file heading is displayed. The files will be displayed by file number:

PLATE TO PLATE
USER #4567 FILE #14

PLATE EMPTY-FILL
USER #4567 FILE #17

PLATE EMPTY-FILL
USER #1234 FILE #22

SERIAL DILUTION
USER #28 FILE #32

PLATE TO PLATE
USER #28 FILE #37

SERIAL DILUTION
USER #1234 FILE #45

6. Press the [stop] key. DIRECTORY COMPLETE; ENTER NEW FILE # will appear on the display. Press [enter], for the next display:

FILE DIRECTORY
ALL - BY TYPE - BY USER

7. Press [no] and [enter], to review by type. When you see this information on the display, press [6] and [3], and [enter], to review type 63 (Plate-to-Plate) files.

FILE DIRECTORY
ENTER FILE TYPE #

8. Press [yes], when you see this in the display:

FILE DIRECTORY
VIEW

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9. Press the [step] key, after each file header is displayed. The Plate-to-Plate files will be displayed by file number:

PLATE TO PLATE
USER #1234 FILE #12

PLATE TO PLATE
USER #4567 FILE #14

PLATE TO PLATE
USER #28 FILE #37

10. Press the [stop] key, and **DIRECTORY COMPLETE** will appear on the display. Press [enter], and this will appear:

FILE DIRECTORY
ALL - BY TYPE - BY USER

11. Press [no] [no] and [enter], to review by **user** (operator or project) identification number. When the following is displayed, press [1] [2] [3] [4] and [enter], to review files relating to operator or project #1234:

FILE DIRECTORY
ENTER USER #

12. When the following is displayed, press [yes]:

FILE DIRECTORY
VIEW

13. The following will be displayed:

PLATE TO PLATE
USER #1234 FILE #12

14. Press the [step] key, after each file header is displayed. The following files will be displayed in order, by user or project number:

PLATE EMPTY-FILL
USER #1234 FILE #45

SERIAL DILUTION
USER #1234 FILE #45

15. Press the [stop] key and **DIRECTORY COMPLETE** will appear in the display.

16. Delete the stored files, by pressing [file] [clear], as you step through each of the files in the directory.

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WellPro Calibration Procedures

Introduction

This section describes how to verify the accuracy and precision of the performance of your WellPro. The gravimetric method is the preferred method of verification. This procedure utilizes the weight of water, to determine the volume dispensed. It is the most accurate and controllable method. Other methods can be devised, based on transferring a solution of potassium dichromate and determining the absorbance; transferring a solution of fluorescein or rhodamine, and determining the fluorescence; or transferring a radioisotope, and determining the radioactivity. These methods are difficult to control, and are subject to variations in detection. They are to be considered secondary, and are not recommended.

Your laboratory policy should determine the frequency with which you carry out the verification. It should be based on the types of samples used, how frequently the WellPro is used, and the maintenance program you have instituted. With a new WellPro, test eight samples from each tip, to determine precision and accuracy. Subsequent verification can be carried out using the procedures in the Quality Control section. Keep records of raw data, on photocopies of the forms provided. This collected data will help you and Denley Technical Service identify any problems.

The WellPro is factory calibrated and tested, to insure the proper volume delivery. Calibration should be performed by qualified personnel. If recalibration becomes necessary, call Denley Technical Service.

Gravimetric Method

The gravimetric method of verification requires you to weigh each individual well that contains water to be dispensed from the WellPro. The analytical balance that you use should be well-maintained, calibrated with an appropriate set of National Bureau of Standards certified weights (NBS Class S Weights; NBS Handbook 105-1, Circular 547), and capable of reading 0.001 g ± 0.0003 g. The gravimetric method, also, requires a thermometer. It should be calibrated and readable to 0.5°C. You can order additional disposable calibration weighing wells and trays from Denley.

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The water that you use, in the gravimetric method, may be subject to evaporation, depending on the environmental conditions during verification. Weigh the water quickly, to maintain accuracy. Do this by dispensing water, one row at a time, and weighing the amount of water added to each well. (A row of twelve wells typically takes five minutes to weigh). Repeat this procedure for each row, until all eight rows have been weighed.

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Materials Required for Gravimetric Verification
These are the materials required for gravimetric verification:

1. Analytical balance
2. Calibrated thermometer
3. Calibration weighing wells
4. Calibration plate
5. Forceps
6. High purity water
7. New WellPro tip magazine and tips
8. Photocopy of the gravimetric worksheet from this manual

Calibration Procedure

1. Assemble all items, and allow them to equilibrate, at room temperature, for a minimum of one hour. During this time, use File 70, to determine the well bottom and 200µL heights for the calibration plate. The **Tip Height** sample file demonstrates how to use the file.
2. Weigh each well of the calibration plate. Record all data on the worksheet.
3. Place a 12 way template on the table.
4. Place a magazine of tips in the back position of the template.
5. Manually pipette 100µL of water into each of the 96 wells of plate 2. An alternative method is to use the pump and File 61, to deliver the 100µL.)
6. Place plate 2 in the middle position of the template.
7. Place the calibration plate that contains the preweighed wells, in the front position of the template.
8. Press [file], [6] [3], and [enter], to access File 63.
9. Use the file, using the following keystrokes:

Display Before Editing	Keystrokes	Display During Review
PLATE TO PLATE STEP TO EDIT FILE#63	[step]	
TRANSFER DIRECTION P2 TO P1 - P1 TO P2	[step]	TRANSFER DIRECTION P2 TO P1 - P1 TO P2
VOL IN WELL PLATE 1 (0-350) 0 UL	[step]	VOL IN WELL PLATE 1 (0-350) 0 UL
VOL IN WELL PLATE 2 (0-350) 100 UL	[step]	VOL IN WELL PLATE 2 (0-350) 100 UL
TRANSFER MODE 1 TO 1 - 1 TO SEVERAL	[step]	TRANSFER MODE 1 TO 1 - 1 TO SEVERAL
TRANSFER VOLUME (0-100) 50 UL	[step]	TRANSFER VOLUME (0-100) 50 UL

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MIXES BEFORE TRANSFER (0-9) 0	[step] [step]	MIXES BEFORE TRANSFER (0-9 0
MIXES AFTER TRANSFER (0-9) 0	[step]	MIXES AFTER TRANSFER (0-9) 0
CHANGE TIPS? YES-NO	[step]	CHANGE TIPS? YES-NO
PLATE 1 TYPE FLAT-U-V-HEIGHT-TUBE	[no], [no], [no] [step]	PLATE 1 TYPE FLAT-U-V-HEIGHT-TUBE
WELL BOTTOM HEIGHT (100-3500) 100 UL	####; [enter] (100-3500)	WELL BOTTOM HEIGHT ####
200 UL HEIGHT (0-####) 0	XXXX; ENTER	200 UL HEIGHT (0-####) XXXX
PLATE 2 TYPE FLAT-U-V-HEIGHT-TUBE	[step]	PLATE 2 TYPE FLAT-U-V-HEIGHT-TUBE
TRANSFER ROWS A-B-C-D-E-F-G-H	[yes], [no] 7 times [step]	TRANSFER ROWS A- - - - - - -
LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW	[step]	LIQ HANDLING SPEEDS RAPID-MEDIUM-SLOW
LINK TO STORED FILE (0-45, 0 = STOP) 0	[step]	LINK TO STORED FILE (0-45, 0 = STOP) 0
END OF FILE	[enter]	
RUN-STORE		
PLATE TO PLATE START TO RUN FILE #63	[start]	

10. Quickly weigh each well of the row dispensed.
11. Repeat steps eight through ten, for each row. Edit the file, to block out all rows, except the one that you are going to fill. (The next row will be B. Other keystrokes are [no], [yes], and [no] six times.)
12. Subtract the initial weighing from the final weighing, for each well.

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Calculations

Perform the following calculations, to determine the WellPro's accuracy and precision:

1. Determine the arithmetic mean (average) weight of each column. Add all sample (net) weights together, and divide by the number of samples.
2. Calculate the mean volume, at the determined water temperature, by using the mean weight and volume conversion factor formula:

   Volume = Weight x Volume Conversion Factor

Volume Conversion Factor

Water Temperature °C	Conversion Factor
15.0	1.002
17.5	1.002
20.0	1.003
22.5	1.003
25.0	1.004
27.5	1.005
30.0	1.005

3. Determine the standard deviation (SD) of the individual volumes, within each column:

   $SD = -\sqrt{[(\Sigma I\ Wi - \overline{WI^2}) / 11]} \times 1 / \text{density} = \sqrt{[(\Sigma I\ Vi - \overline{VI^2}) / 11]}$ Volume Conversion Factor

4. Determine the coefficient of variation (CV):

   CV = (SD x 100%) / Mean Volume

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Date:_____
Tech:_____
Temperature:_____

Gravimetric Worksheet

	1			2			3			4		
Row	IW_	FW_	NW_	IW	FW	NW	IW	FW	NW	IW	FW	NW
A												
B												
C												
D												
E												
F												
G												
H												
W												
Vol												
SD												
CV												

	5			6			7			8		
Row	IW	FW	NW	IW	FW	NW	IW	FW	NW	IW	FW	NW
A												
B												
C												
D												
E												
F												
G												
H												
W												
Vol												
SD												
CV												

	9			10			11			12		
Row	IW	FW	NW	IW	FW	NW	IW	FW	NW	IW	FW	NW
A												
B												
C												
D												
E												
F												
G												
H												
W												
Vol												
SD												
CV												

IW =Initial Weight, FW = Final Weight, NW = Net Weight

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Calibration of Non-Aqueous or Viscous Solutions

Introduction

Denley has calibrated the WellPro with water. Water has unique viscosity, surface tension, and binding characteristics.

Other liquids differ in these characteristics. These differences may affect the WellPro's accuracy and precision. It is important to evaluate the effects of different solutions on your experiments. This procedure can be used to perform this evaluation. Make photocopies of the worksheet, record your raw data, for future reference.

Procedure:

1. Weigh a known volume of sample, in a volumetric flask. Be sure to maintain routine lab temperature.
2. Calculate the density of the solution, by using the formula: **d = weight / volume**.
3. Perform a shortened version of the Calibration Procedure, at routine lab temperature. Use your routine file sequence. Weigh the Row B wells, at this temperature.
4. Calculate the arithmetic mean (average) weight (W), by adding all sample weights, and dividing by the number of samples (12).
5. Calculate the volume dispensed. Divide the mean weight dispensed by the density.
6. Calculate the standard deviation (SD) of the individual volumes, with this formula:

$$SD = -\sqrt{[\Sigma IWi\text{-}\overline{WI^2} \ / \ 11]} \times 1 / \text{density} = \sqrt{[\Sigma IVi\text{-}\overline{VI^2} / 11]}$$

7. Calculate the coefficient of variation (CV):

   $CV = (SD \times 100\%) / \text{mean volume}$

   Make volume corrections, by modifying WellPro file volume settings (e.g.: if 46µL are dispensed, for a viscous solution, when 50µL are anticipated, enter 54µL (50 x 50/46) into the WellPro controller, to compensate for the change).

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Date:_____
Solution:_____
Temperature:_____
Tech:_____

Non-aqueous or Viscous Solution Worksheet

density:

Volume Weighed: _____

D = Density: _____

Weight / Volume =_____

Weight: _____

WellPro Weighing:

	Row B
1	_____
2	_____
3	_____
4	_____
5	_____
6	_____
7	_____
8	_____
9	_____
10	_____
11	_____
12	_____

W = Mean Weight = W/12 = _____

Volume Dispensed = W / D = _____

Standard Deviation = $\sqrt{\overline{[IVi-VI^2 / 11]}}$

Coefficient of Variation = (SD x 100%) / W = _____

Calibration Setting = _____

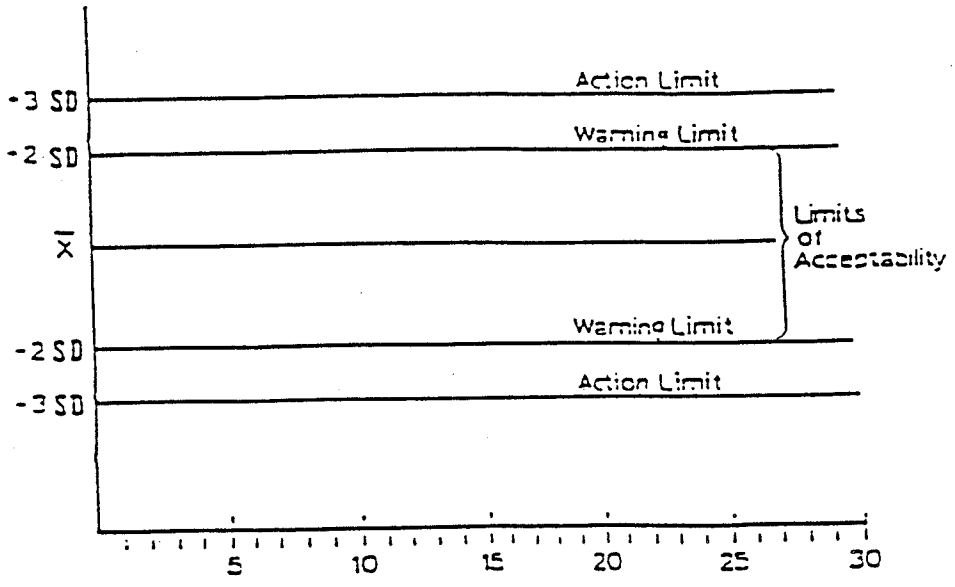
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Quality Control Procedures

All laboratories should have functioning quality control programs, to provide verification of the accuracy and precision of test results.

The use of assayed control samples is helpful in monitoring the overall performance of the WellPro and of the reagents used in an assay. For example, it is a good practice, with serum samples, to assay serum controls, in the normal and abnormal ranges, with each batch of samples. When using commercial control sera, the value of each control should fall within the manufacturer's stated acceptable range for the analyte. When a commercial control is not available, make controls by adding known amounts of the analyte to a normal serum pool. For research specimens, add known amounts of analyte to the appropriate matrix. Aliquot into containers, and store at optimum temperature for sample stability. For maximal control, choose a minimum of three levels of concentration: low, mid-range, and high. You may wish to choose additional concentrations, at decision points or questionable points, on the standard curve, where necessary.

A Levey-Jennings control chart, as shown in the next figure, provides the simplest way to present daily control data. The chart is a sheet of rectangular coordinate graph paper, marked with days on the horizontal axis and assay units on the vertical axis. The mean value, as well as the **limits of acceptable error**, are indicated on the chart. They are based on past laboratory experience (typically, mean ± 2 standard deviations). Plot the daily value on the control chart, so that you can see trends and/or any point that falls beyond the **limits of acceptable error**.



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Verification

Verification of WellPro calibration, without the contribution of the reagents, can, also, be part of your laboratory. Weigh Row A wells, or a T of wells, made of Row A and Column 6, and construct a Levey-Jennings control chart, using the mean (average) values for the Row and for the Column.

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Service and Maintenance

Introduction

The WellPro has been designed to operate with materials and samples commonly found in laboratories. Use **extreme caution,** when working with corrosive, toxic, mutagenic, carcinogenic, teratogenic, infectious, pathogenic, or otherwise hazardous samples. Such samples and materials should always be clearly labeled, and waste material disposed of properly. Use **caution,** when operating the WellPro System, with such samples, and be certain to clean and decontaminate any spilled material. **Never** attempt operation of the instrument with the plastic safety cover removed.

Preventive Maintenance and Decontamination

Keep your WellPro clean and free of chemicals, dirt, and dust, to ensure trouble-free operation. Any liquids spilled on the WellPro should be wiped off immediately.

Keep you WellPro free of any corrosive reagents. Wipe spills immediately. Clean noncontaminated work surface regularly, with a damp cloth. Refer to the sterilization procedures, for spills involving contaminated material.

Piston Plungers

Apply a light silicone grease, occasionally, with a clean cloth or lint free towel. Gently wipe the piston-plungers of the 12-channel and single channel head. This will keep them sealing well and inhibit corrosion.

Table Rails

The table rails must be kept clean and free of foreign matter, to ensure smooth operation. Clean these, periodically, by wiping with a clean cloth. **Ensure that power is off, before cleaning the table rails.**

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Template Removal and Decontamination

Turn the WellPro off, and remove any microtitration plates or reagent containers, from the table. Remove the template by lifting upwards and forward.

Do not autoclave the template. Decontaminate the template by chemical means.. Use of dilute chlorine bleach solution, 70% (v/v) of Ethanol or Isopropyl alcohol is adequate. Do not use organic solvents or gluteralderhyde disinfectants.

Microtitration Plate Sterilization

The microtitration plates cannot be sterilized in an autoclave, as they will melt. Consult your microplate manufacturer, for information regarding non-destructive decontamination procedures.

Cleaning of Plastic Cover

Denley recommends that you periodically clean the plastic covers. Use a dilute solution of a mild, nonabrasive cleaner, and rinse with a soft clean damp cloth. Do not use organic solvents. They will damage the covers.

Decontamination may be performed by chemical means. Chlorine bleach is an acceptable decontamination solution. Ethanol and gluteraldehyde should not be used on the plastic surfaces. **Do not autoclave.**

Instrument Malfunctions

Service or repair work on the WellPro operating circuits or mechanism should be performed by qualified personnel. See the Service Policy section, if the instrument requires service.

Power Interrupts And Homing The Instrument

If power is interrupted, these conditions will be present when power is restored:

- If a file was being edited, it will be lost. The file will have to be reedited.
- If a file had just been stored, the WellPro will still have the file in memory.
- If you were are in the middle of a run, the run will be lost. Home the instrument, to sequence back to a point where you can start over.

Cover Removal

Warning!

Do not remove the blue plastic cover, while the WellPro is operating or powered. There is risk of electrical shock or injury, if the WellPro is operated without the cover.

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Grounding and Electrical

The WellPro liquid handler must be properly grounded, to protect against electrical shock. **DO NOT** use any adapter which circumvents the power cord grounding connector. Ensure that power is disconnected, before moving or cleaning the instrument. Refer all service and maintenance, other than routine procedures described in this manual, to qualified service personnel. **DO NOT** open the back panel of the instrument. There are no user serviceable parts inside.

Fuse Replacement
Replace the instrument fuse (located on the back panel) with the same type and rating as originally supplied, for continued protection against electrical overload and fire hazard.

Radio Frequency Interference

The WellPro generates radio frequency energy. It may cause interference to radio communications. It has been tested, and found to comply with the limits allowed for Class A computing devices, pursuant to Subpart J and Part 13 of FCC Regulations.

Spills

Avoid spilling solution on or in the instrument. Although all electrical components, within the instrument, have been shielded or sealed against fluid contact, there may be harmful, long-term effects, from corrosion or salt accumulation.

Clean up spills immediately, to ensure maximal safety and trouble-free operation. Prompt cleaning is especially important, if infectious or corrosive materials are being used. Denley recommends special caution, when cleaning spills containing infectious or corrosive materials.

Turn off and unplug the WellPro, before wiping up spills.

If infectious material spills involve the head, table, dispense manifold, tips, or microtitration plates, remove and sterilize them (see Sterilization Instructions.)

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Ambient Temperature

The WellPro has been calibrated for an operational range of 20-26°C (68-79°F). Operation outside of this range may affect the volume calibration. Evaluate the instrument's calibration, whenever you work outside of the specified temperature range. (See **Calibration Procedures**.)

Make volume corrections by modifying file volume settings (e.g.: if the operating temperature is 35°C, and 103µL are dispensed, when 100µL are anticipated, enter 97µL (100 x 100/103) into the file, to compensate for the change.)

It is possible to make a permanent change, to make automatic volume corrections, if you continually work outside of the specified temperature range. Call Denley Technical Service, for details.

Sample Temperature And Viscosity

The WellPro is calibrated for instruments and samples in the 20-26° C (60-79°F) range. When solutions are at higher or lower temperatures, as is common in biological work, the accuracy and precision of the volume may vary, due to contraction or expansion of the initial air in the tip. Many solutions, such as 20% glycerol, exhibit radical viscosity changes, when cooled. These changes may affect accuracy and precision. See the **Calibration Procedures** section, and use the gravimetric procedure to evaluate these effects.

Tips

The WellPro has been calibrated using disposable tips. The tip design and the manufacture of internal volumes, orifice diameters, lengths, etc., to tight tolerance limits, assure the accuracy and precision of the liquid handler system. The length of the tips is important, since the proper draw-off of liquid, from the tip, depends on its depth in the liquid which it contacts. Tips not manufactured by Denley may decrease the accuracy and precision of the system.

When the wrong length tips come into contact with the bottom of a well, a seal may be formed. Such a seal prevents liquid from being drawn into the tips. This causes the vacuum to remain in the tips. As the tips are raised, liquid and air may, rapidly, enter the bottom of the tips, causing contamination of the plungers, transfer of grossly inaccurate volumes, and disruption of attached cells.

Prerinsing Tips

Change tips, for maximum precision and accuracy, and minimal carryover, during transfer of liquids. If you elect not to change tips, prerinse (or prewet) them. Specify a minimum of one MIX BEFORE TRANSFER, while editing the file.

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Editing A File

Use [step] with caution, while editing files. If you change the value of a parameter, while reviewing a file, it is very important that you [step] through the file, to END OF FILE. This allows the WellPro controller to check the value of any parameters that are dependent on the one just changed.

Short Fills Using (optional) Carousel

Do not use carousel sample tubes containing less than 3.5 ml of sample, with the automatic liquid level sensing feature.

Elastic Tubing on (optional) Pro/WASH and Dispense Manifold Units

Pump and wash manifold tubing should be flushed with deionized water, after use. The elastic tubing may be cleaned in a mild detergent solution, and rinsed with water. Tubing should not be under tension (in the peristaltic pump and wash solenoid), during WellPro idle time, in excess of eight hours, as it will degrade the elastic properties. During these times, remove the tubing from the pump clamp and shell. Remove the wash tubing from the solenoid, also. Elastic tubing should be replaced, wherever signs of abrasion, cracking, discoloration, or deformation become apparent.

Removal for Cleaning of (optional) Dispense Manifold Tubing

Turn the WellPro off, before removing the tubing from the manifold. Disconnect the connector at the manifold.

To remove the tubing, from the pump:

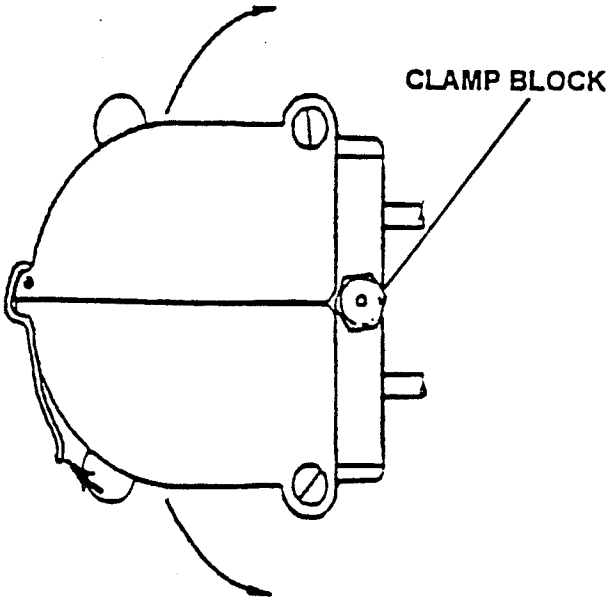
- Push the latch open (back of the pump cover), and swing the two halves of the cover open, as illustrated in the accompanying figures.
- Loosen the front nut, so that you can take off the plastic clamp block.
- Carefully pull the tubing out of the pump.

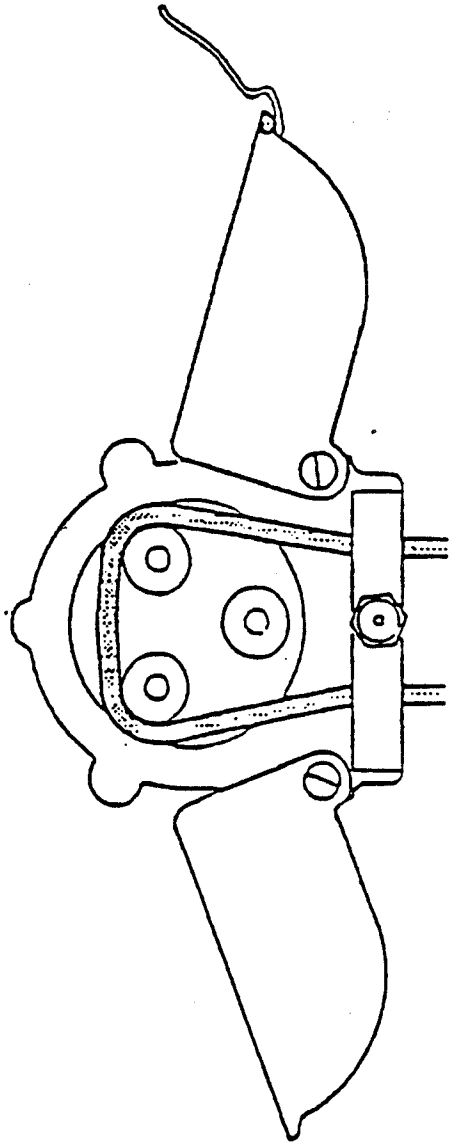
To replace the tubing:

- Push the tubing back into the peristaltic pump.
- Swing the two halves of the cover back into position.
- Snap the latch back into the closed position, while pinching the halves together.
- Place the tubing in the slots of the block.
- Replace the outer block. Be careful not to cross-thread the screw.
- Prime the pump, using File 0.
- Tighten the nut.

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These figures illustrate how to open the two halves of the cover:





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(optional) Peristaltic Pump Maintenance

The optional peristaltic pump requires no maintenance, other than occasional cleaning with a soft cloth.

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Installation of New Tubing for the (optional) Pro/WASH System

1. Remove the WellPro's blue plastic dust cover:
   - Swing the bottom of the cover forward and up, about one inch.
   - Slide straight up to remove.

2. Remove the dispense manifold, from the wash head assembly.
3. Connect the hose lines to the Pro/WASH head. These lines attach to the nozzles on the top wash block unit, which sets in the center of the Pro/WASH carriage. The wash block fastens to the Pro/WASH carriage with two screws. Remove the wash block from the Pro/WASH carriage, before connecting the hose lines. Measure and cut tubing, for the three hoses shown in the figure. Connect and route these hose lines in the following manner:

   1. **The Pump Hose**
      Connect this hose to the nozzle furthest to the right on the wash block. Route the hose from the nozzle, through the wash peristaltic pump, to the wash solution, container.

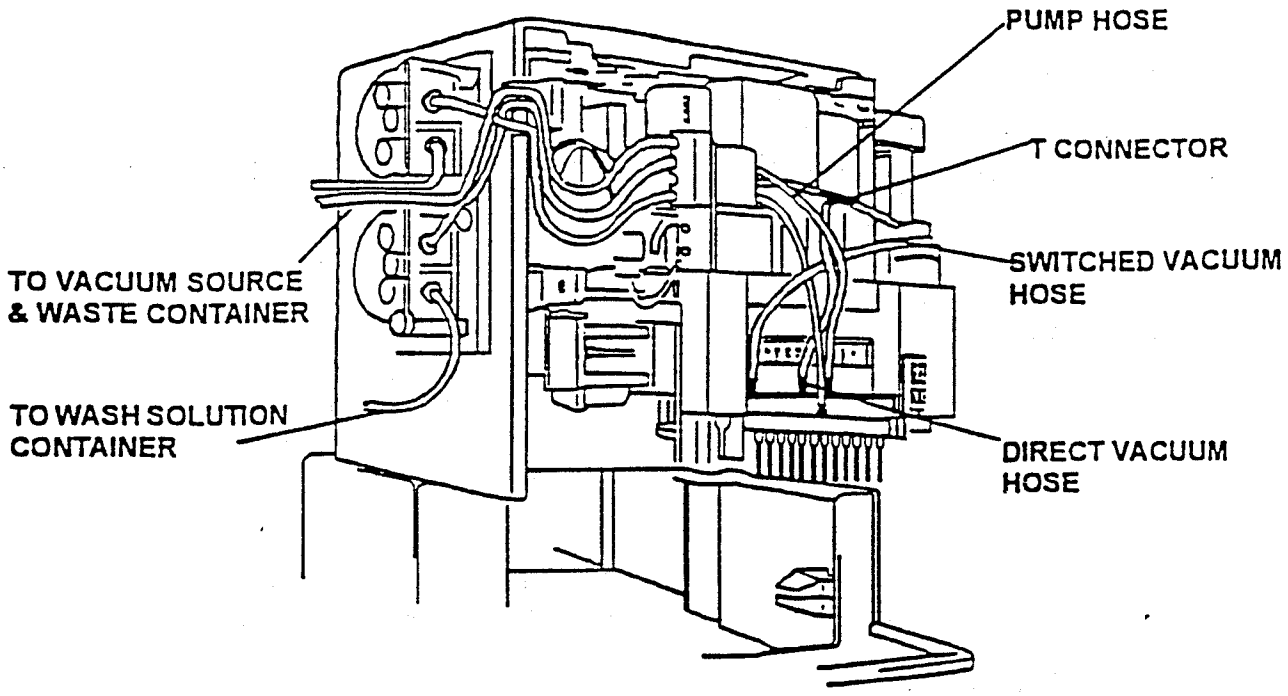
   2. **The Switched Vacuum Hose**
      Connect this hose to the nozzle furthest to the left on the wash block. Route the hose from the nozzle through the solenoid switch, on the Pro/WASH carriage, and attach to one arm of the supplied T connector.

   3. **The Vacuum Hose**
      Connect this hose to the middle nozzle of the optional wash head. Route the hose from the nozzle to another arm of the T connector. Route this hose from the remaining arm of the T connector, to your waste trap and vacuum system.

      After all tubing has been connected, fasten the wash block to the Pro/WASH carriage. Check to make sure that the hose lines have sufficient clearance for operating the Pro/WASH system and that the hoses are secured out of the way of the machine's moving parts. Replace the dispense manifold into the holder, and tighten the thumb screw.

      Replace the blue plastic cover, and turn on the WellPro. Home the instrument, by pressing [file] [0] and [enter]. This will bring the head to the correct starting position. Prime the pump and the Pro/WASH head, by following the FILE 0: Homing and Priming sample file.

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Pro/WASH Tubing Routing

Maintenance of the Capillaries of the (optional) Pro/WASH

Misalignment and the creasing of the tubing, in the peristaltic pump, can cause the cannula to drip. Check and maintain the tubing that delivers the wash solution to the cannula, to avoid dripping of the Pro/WASH cannula. If dripping is a problem, realign the tubing in the pump. Replace the tubing, if necessary. Leave the pump housing clamp open, when the machine is not in use. This will minimize creasing of the tubing, and eliminate the dripping of the cannula. Flush the wash block, with deionized water, between use, to keep the cannula from clogging.

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General Care and Maintenance

Caution

Repair professionals should question operators, to determine if the instrument is safe to handle, **due to the nature of the liquids being handled by the WellPro**. If there are any doubts, Denley suggests that you request that customers sign a statement of decontamination, as used in RGAs, and use appropriate precaution and protective covering against the agents handled by the instrument. If you have any open sores, cuts or scratches, use gloves and scrub thoroughly after the service is complete.

Cleaning the Exterior Surfaces

The WellPro can be easily cleaned, using a mild soap solution. Commercially available cleaning solutions work very well to remove any dirt and grease, but do very little to decontaminate any surfaces. Do not use any cleaners that contain abrasives, as this might damage the painted or anodized surfaces, and can dull the finish of plastic and stainless steel surfaces.

Sterilization of WellPro Parts

The WellPro is used with many radioactive isotopes, chemicals, and potentially biologically hazardous materials, in particular human blood samples. The sterilization of the WellPro hardware is the responsibility of the operator/owner and not the maintenance personnel. If you are asked how to sterilize parts, refer the person to the User's Manual.

The WellPro has been finished with a paint that is semi-resistant to the long term effects of ultraviolet light. The painted surfaces may in time discolor and there is no cleaner that can restore the original color to the paint. The paint and colored surfaces are not damaged by the light, only discolored.

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Preventative Maintenance

1. Ask users if there are any areas that may need special attention.
2. Correct any problems, prior to proceeding. If you find a problem, while performing preventative maintenance, repair the problem immediately. Return to the beginning, and restart the test sequence.
3. Repair technicians should see that the unit is clean and safe to handle. If it is not clean, the technicians have the option of requesting that the operator(s) clean the instrument, prior to any service being performed. If the operator(s) refuse to clean and sign the release form, if requested by the service technician, the service may be refused, and the customer may be charged for travel expenses to the facility.
4. Turn the power on. It is not necessary to home the instrument.
5. Enter the configuration files. For future reference, record all of the configurations on a configuration worksheet.
6. Turn the power off.
7. Remove the power cord and backpack from the instrument.
8. Put on an antistatic wrist strap, and remove one board. Place the board on a flat surface, and lightly push down on each of the socket-mounted IC components, to verify that all hardware on the boards is secure.
9. Look for visible signs of component fatigue, such as discoloration of components, due to heat.
10. Replace the board, in the appropriate slot, and remove and check the next board.
11. After all of the boards have been checked and replaced, inspect the backpack wiring for any loose connections. Do this by gently grabbing each wire, above the crimp-on connectors, and gently tugging. There should be no evidence of a loose crimp or connector. Repair or replace as needed.
12. Replace the backpack. Be careful not to pinch the ribbon cable between the backpack and tower casting.
13. Inspect the head for damage or fatigue. Pay careful attention to the tapered end of the nozzles.
14. Check the tapered end of the nozzles for chemical deterioration and scratches.
15. Clean all of the alignment rods. Lubricate them, lightly, with a medium consistency silicon grease.
16. Check the transverse drive belt for signs of wear or cracking. Replace if necessary.
17. Check the tightness of the pulley follower on the X-Y head.
18. Fill one position of a trough with water. Load a row of tips into the back row of the trough.
19. Turn power on, and home the instrument. Decline the prime pump option.
20. Select File 61. Edit the file to fill one or more rows, of either plate, with 200µL from the trough that has the water.
21. Press [start].
22. When the tips enter the trough, press the [stop] key. Press [step] for single step mode.
23. Use the [step] key, to single step through the file, until the tips have aspirated water. Leave the tips in the water.
24. Watch the liquid level, in the tips, for any noticeable loss of volume. Any loss noted in a two minute period indicates a bad seal.
25. If a leak is detected, lubricate or replace the seals. Follow the seal replacement procedure in the Service Manual.
26. When the head passes the leak test, press [stop]. Press [start], to exit the file and return to the home position.
27. Insure that all external hardware is in place and is secure.

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28. Have the customer run the instrument in your presence. Verify that the customer is satisfied with the operation of the instrument.
29. Complete a Field Service Report. Have the customer sign after acceptance. This will complete the preventative maintenance procedure.
30. Attach the preventative maintenance checklist to a copy of the field service report, and return it to the Denley Instrument Corporation technical support office.

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Troubleshooting

Troubleshooting Outline

This section addresses general WellPro troubleshooting procedures. All procedures should be performed by qualified service professionals, familiar with factory service procedures. Follow normal precautions, when troubleshooting.

If any person or persons, not employed by Denley / LSI, or its authorized distributors, repair(s) a WellPro, they assume responsibility for any warranty, in effect, and releases Denley from any responsibility for the correct operation of the unit.

Troubleshooting Guide

Tips fall off:

- Incorrect tip used
- Defective Tips
- Tip not clearing tube (head cogs)
- Nozzle undersized
- Nozzle oversized
- Plunger flag incorrectly set, piston protruding too far through the nozzle

Tips won't eject:

- Nozzle oversized
- Eject pulse incorrect
- Seal in tip too tight, defective tips
- Defective solenoid(s)
- Transverse head has cogged
- Eject position in configs. bad
- Defective motor driver board
- Missing ejector shaft washers

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Controller goes blank:

- Check Controller cord
- Check Pico fuse on mother board FU 3
- Check main fuse
- Defective CPU board

The unit blows a fuse (FU 1 or FU 2). when [start] is depressed

- Shorted wiring
- Shorted motor driver board
- Wire bundle under tower shorted (unused wires)

Wash head cogs:

- Defective wiring
- Motor wired out of phase
- Tubing between block or solenoid too tight
- Block mounted backwards
- Tight supernut

No liquid sense (only used with carousel):

- Leak in head tubing to ADC sensor
- Tubing is disconnected, loose, or split
- Incorrect ADC threshold (config. #36)
- Bad seal between nozzle and tip
- Defective ADC Board
- Defective wiring between CPU and ADC Board
- No liquid in tube or level too low
- Bad seal(s) in liquid head piston
- No tip on nozzle or in carousel

Tube barcode reader errors (only used with carousel or plate stacker):

- Label too high or low on tube
- Reader operating too fast
- Reader misaligned
- Defective wiring to reader
- Defective label
- Motor defective on scanner
- Defective scanner
- Defective barcode board
- Tube missing or mispositioned

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Plate barcode errors (must have carousel or plate stacker):

- Label missing or mispositioned
- Reader out of alignment
- Plate incorrectly positioned
- Defective reader
- Defective wiring to reader
- Defective barcode board

Controller shows *self test ok* and *running*, and no motors are moving:

- Check that connector to head motor is connected
- Check the connector on the motor driver board(s)
- Defective motor driver board
- Defective Pico fuse on the mother board FU 1 or FU 2
- Check wiring continuity to the motor
- If all of the above works replace the CPU board

Controller displays *no motor driver board on startup*:

- Check for the presence of all boards, for the options installed
- Check that all the boards are secure in the connectors
- If all the above works, replace the duart Z16 or 27, on the motor driver board.

Instrument only works with backpack removed:

- Shorted multicolor ribbon cable
- Loose or shorting components
- Loose crimp connectors on the backpack

Head cogs or chatters (loses reference):

- One wire to the motor is open (Check the molex connector)
- Connector on the motor driver board is loose
- Motor driver board is defective
- Driver motor is out of alignment (loose hardware)
- Defective motor
- Assembly movement is obstructed
- Spring pin on lead screw is sticking out and hitting the supernut
- Lead screw and bushings are dirty

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Bed cogs or loses reference:

- Bed movement is obstructed (plate hitting barcode reader in the bed path)
- Belt is loose
- Motor is wired out of phase
- Defective wiring to motor
- Flag is hitting Hall effect
- Table is hitting something behind the instrument
- Motor driver board is defective
- Bed rails need cleaning

Carousel cogs or loses reference:

- Ejected tip is jamming platter
- Roller is loose or broken
- Belt is loose or broken
- Flag striking Hall effect
- Motor is defective
- Wiring is defective
- Motor driver board is defective

Motor runs, but there is no assembly movement:

- Lose set screw on shaft
- Roll pin is sheared or missing
- Sheared shaft on the motor
- Broken supernut or gear assembly
- Loose or broken belt

Motor drives to limit / motor continues to drive at limit:

- Defective Hall effect device
- Defective Hall effect wiring
- Flag is missing
- Defective motor driver board
- Flag is aligned out of tolerance

Motor error message on motor movement:

- Incorrect configurations
- Hall effect device has intermittent short
- Motor has cogged (see motor error listing):
- Incorrect plate information in height file
- CPU is defective

Controller dead:

- Defective controller cable
- Open Pico fuse on mother board FU 3
- Controller is defective

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Service Policy

Call Denley Instruments Technical Service, for service problems which cannot be handled by referencing the User's manual. A Denley technical service representative may be able to resolve the problem over the telephone, using basic check-out procedures. If the problem cannot be resolved, this way, the Denley technical service representative will arrange for a field service representative to visit your lab, to repair the unit. If the unit cannot be repaired in your lab, a Return Authorization (RGA) will be issued. All returned goods must be accompanied by RGAs. Any merchandise received without an RGA, will not be accepted. WellPros should be securely packed, in original packing or similar cartons, for return, to minimize the possibility of in transit damage. All service repairs (excluding freight) that are covered by the warranty will be performed without expense to the user. Out-of-warranty service repairs will be made at the prevailing rates, at the time of the repair.

Limited Warranty

Subject to the exceptions and upon the conditions stated below, Denley Instruments warrants that the product shall be free from defects in workmanship and materials for the period of one (1) year after delivery of the products to the original buyer. Denley agrees, at its option, to either repair or replace, with an equivalent product, any such defective product, provided that investigation and factory inspection discloses that defect developed under normal and proper use. The exceptions and conditions are as follow:

(a) Denley makes no warranty with respect to components or accessories not manufactured by it; in the event of defect in any such component or accessory. Buyer's sole remedy, if any, is against the manufacture of such component or accessory.

(b) Any product claimed to be defective must, if required by Denley, be returned to the factory, transportation charges prepaid, and will be returned to Buyer with transportation charges collect unless the product is found to be defective, in which case Denley will pay all transportation charges.

(c) If the product is a disposable plastic, glass or other part or the like, it is warranted only to conform to the quantity and content stated on the label at the time of delivery.

(d) Denley may, from time to time, provide a special printed warranty, with respect to a certain product, where applicable. Such Warranty shall be deemed incorporated herein, by reference.

(e) Denley shall be released from all obligations under all warranties, either expressed or implied, if any product covered hereby is repaired or modified by persons other than its own authorized service personnel, unless such repair are made with written consent by Denley Instruments.

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(f) Denley makes no warranty for the use of disposable plastic or glass or other such products on WellPro equipment when such disposable products are not certified by Denley.

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